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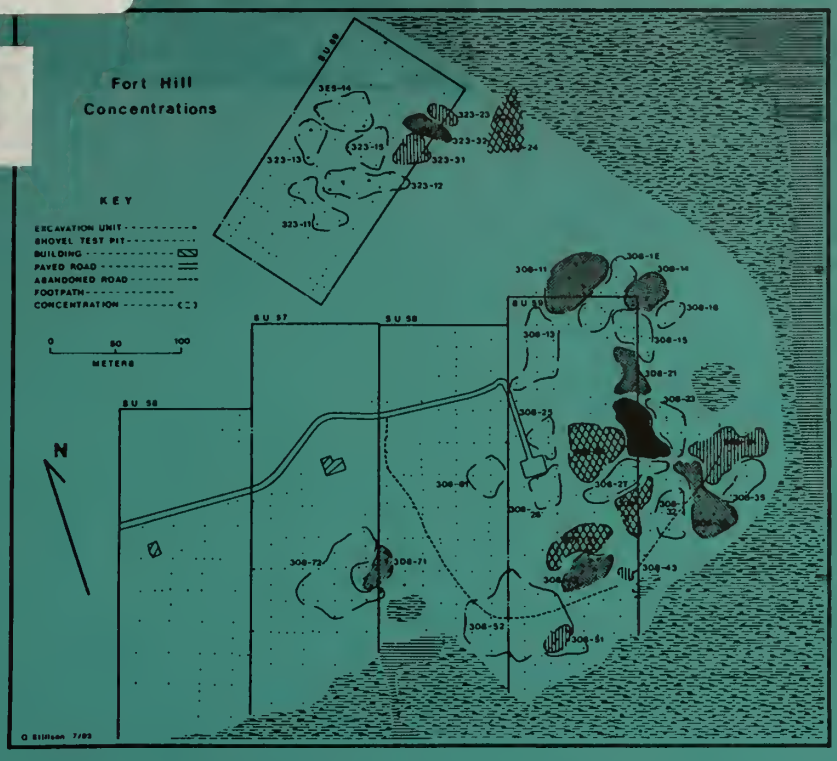

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CHAPTERS IN THE ARCHEOLOGY OF CAPE COD, I

Results of the Cape Cod National Seashore Archeological Survey 1979 - 1981

Volume 2

Cultural Resources Management Study No. 8

Division of Cultural Resources
North Atlantic Regional Office
National Park Service
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1984

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Chapters in the Archeology of Cape Cod, I

Results of the Cape Cod National Seashore Archeological Survey 1979 - 1981

Volume 2

Cultural Resources Management Study No. 8

Francis P. McManamon, Editor

with contributions by

Christopher L. Borstel, Susan A. Chase, S. Terry Childs,

Joyce Fitzgerald, Mary E. Hancock, and Linda A. Towle

Division of Cultural Resources

North Atlantic Regional Office

National Park Service

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EDITOR'S FOREWORD

This is the second volume of the report on the 1979-1981 results of the Cape Cod National Seashore Archeological Survey. These chapters present studies on specific types of archeological remains that have been recovered and analyzed. Chipped stone, floral and faunal remains, shellfish remains, prehistoric ceramics and lithic raw materials all are described and analyed. The last chapter presents a synthesis of much of the data described in these chapters as well as those in Volume 1.

The geographic distribution of remains are described consistently among chapters in terms of "concentrations". These sub-site archeological units are defined in Chapter 4 of Volume 1. A series of foldout maps (A-M) can be found at the end of Volume 2 to help readers locate concentrations within sites, and sites within the study area.

Chapters in both volumes are designed to be used independently if a reader's purpose is to focus on particular kinds of remains. Volume 1 contains chapters describing the survey history and goals as well as other background material.

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CHAPTER 9

Types of Archeological Deposits and Lithic Assemblage Analysis

Francis P. McManamon

This chapter has two objectives. The first is to identify the kinds of archeological deposits represented among the concentrations that were described in Chapter 3. The second is to describe and analyze the lithic assemblages of these concentrations and identify the lithic manufacturing and maintenance activities associated with them.

The Types of Archeological Deposits

Archeological remains result from past human activities; however, only occasionally can inferences about behavior be made without understanding how the remains came to rest in archeological context. As they are discarded or lost, these remains pass out of systemic and into archeological context where they are discovered and unearthed by archeologists (e.g., Gould 1980:113-121; Schiffer 1976; Schiffer and Rathje 1973). Implicit consideration of the passage between contexts has been part of archeological interpretation from its earliest days. In the last ten years, however, explicit attention to the formation of archeological deposits has been urged (e.g., Schiffer 1972, 1976). It is a telling point of the increasing detail and sophistication with which archeologists are viewing their data that Schiffer's call has been taken up by so many. The new attention already has infused archeological investigations with a greater care in research design, fieldwork, and analysis similar to the increased attention to research design and hypothesis testing that occurred about a decade earlier (e.g., Binford 1964, 1968; Watson, LeBlanc and Redman 1971).

Variables for Distinguishing Deposit Types

Two types of archeological deposits are considered here: primary and secondary. Primary deposits are those laid down at the time of the activity that generated them and not moved subsequently. For example, a lithic quarry or workshop where the chipping debris has been left in place. Secondary deposits, on the other hand, are composed of the remains that were generated by activities at one location and subsequently transported to their final resting place. A garbage and trash dump on the periphery of a residential area is an example of a secondary deposit.

> Secondary deposits are characterized by: (1) predominantly worn-out, broken, or otherwise unusable materials, (2) a high diversity of materials, and (3) a high relative density of materials (Schiffer 1976:129).

Variables similar to the last two listed by Schiffer were available to distinguish these types of deposits for the survey data. Using the assemblage and structural data available for each concentration, two factors were used to differentiate secondary from primary deposits:

(1) a high density of remains, i.e., high values for number of lithics/quarter cubic meter, grams of total shell/quarter cubic meter and grams of fire-cracked rock/quarter cubic meter.
(2) a high diversity of lithic artifact types.

These criteria are not foolproof and additional criteria could be devised to help distinguish between the deposit types. However, the two criteria described above were readily available for this data set. They are reasonable characteristics for making the distinction desired here. Further checks on the deposit type assigned to each concentration occurred in the lithic activity analysis to help guard against misidentification using these two criteria alone.

Primary vs. Secondary Deposits The Density of Remains

The density of the deposits in each concentration was described using three variables: (1) the number of lithic artifacts/quarter cubic meter (qcm), (2) the grams of shellfish/qcm, and (3) the grams of fire-cracked rock/qcm. The values for each of these variables for each test unit in a concentration were summed to produce a value for each concentration for each of the three variables. This means that the concentration values are sums of densities rather than simple densities. Using sums had the attractive advantage of making concentrations with high densities for individual units stand out sharply from low density concentrations. This made the concentrations with high densities much more easily distinguishable from the others. Using the sums had the

disadvantage that the number of test units in each concentration affected the overall concentration values for each of the three density variables. This effect is examined below and discounted.

The sums had a distinct advantage over the mean or median values for each concentration because the objective was to identify concentrations with the highest values. The mean and median, on the other hand, would have identified the central tendency of values within each concentration and in some cases would have masked high scores. Sums had the additional advantage of being easily available from the data set that had been used to delimit the concentrations.

As mentioned above, a potential drawback of using sums as density measures was that concentrations were examined with different numbers of test units. It was important to assess the effect of this differential testing, since one might expect that those concentrations with more units automatically would have larger sums. If this were so, the concentrations with more units would appear to have the densest deposits. Two principal characteristics of the data mitigated this bias. First, the concentrations did not vary widely in the number of tests within them. The number of tests varied from 2 to 17 with 75% of the concentrations having between 3 and 11 tests (Figure 9.1). Obviously, though, a degree of positive relationship was expected between number of tests and the sum of the density values. To explore this relationship, a scatterplot of the numbers of tests and values for lithics/qcm was done using the 35 concentrations in sites 19BN308 and 323 (Figure 9.2). The scatterplot shows that a generally positive correlation exists between the number of tests and lithics/qcm. The relation between these variables, while clear, is not overwhelmingly strong. We see, for example, that concentrations with only five or six tests have values above the 75th percentile for lithics/qcm while 17 concentrations with more tests do not. In fact, two out of the three concentrations with the greatest number of tests have sums for lithics/qcm well below the 75th percentile. This example, which could be repeated using other sites and density variables with similar results, supports the use of sums of density variables as indicators of the density of remains in each concentration.

The second main reason that variation in the number of tests does not bias this comparison badly is the substantial variation in values per test for each of the density variables. If the highest and lowest values were not so widely separated, a few additional test scores might thrust a concentration above others that in fact have denser remains, but fewer test units. The densest deposits of lithics, shell, and fire-cracked rock, however, have values far larger than most scores. One or a few of such scores are sufficient to place the score for a concentration among the high scores. Table 9.1 shows an example of the wide variation in values among the scores for individual test units at a series of sites in the Nauset area. The table shows that widely disparate scores occurred among the individual

Frequency	# Units	10 20 30
0	1	
4	2	XXXX
16	3	XXXXXXXXXXXXXXXX
17	4	XXXXXXXXXXXXXXXXX
21	5	XXXXXXXXXXXXXXXXXXXXX
22	6	XXXXXXXXXXXXXXXXXXXXXX
29	7	XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
11	8	XXXXXXXXXXX
17	9	XXXXXXXXXXXXXXXXX
14	10	XXXXXXXXXXXXXX
8	11	XXXXXXXX
6	12	XXXXXX
4	13	XXXX
4	14	XXXX
2	15	XX
1	16	X
1	17	X

FIGURE 9.1: Number of Test Units in Each Concentration
(X = one concentration, N = 176 concentrations)

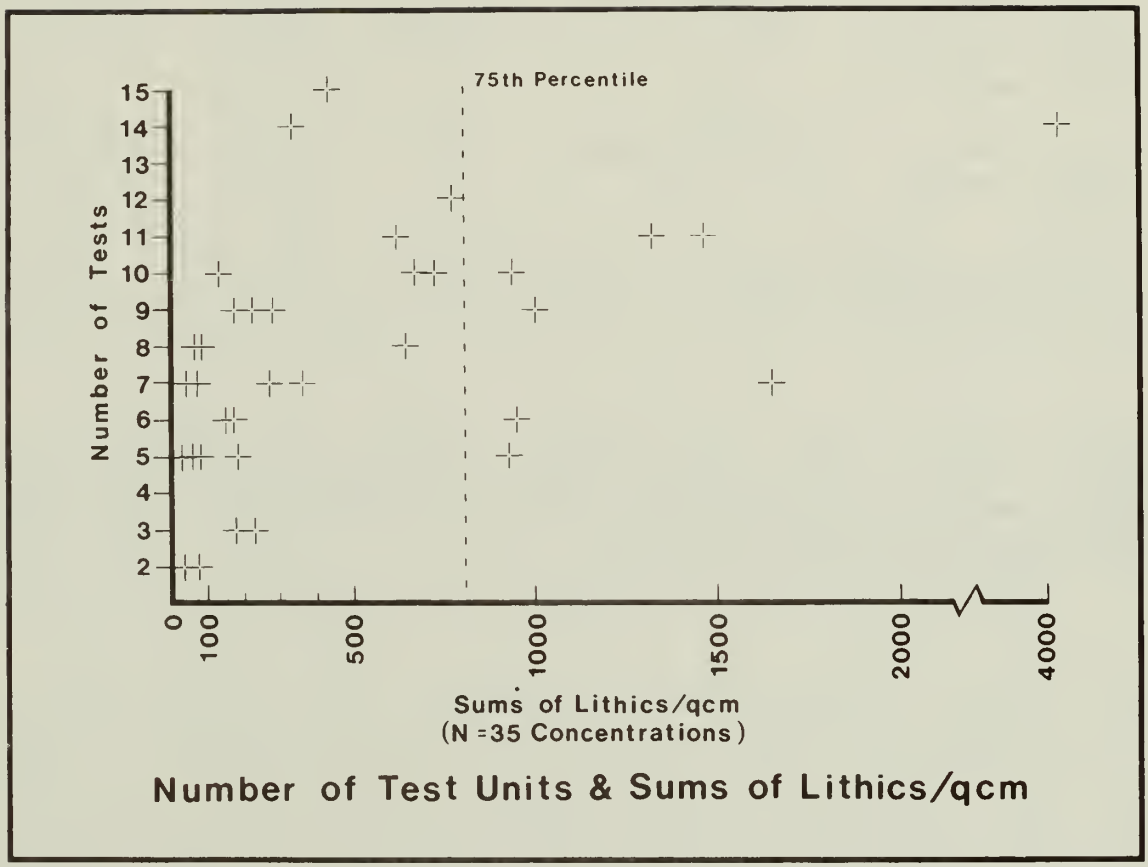

75th Percentile
Number of Tests
15
14
13
12
11
10
9
8
7
6
5
4
3
2
0
100
500
1000
1500
2000
4000
Sums of Lithics/qcm
(N =35 Concentrations)
Number of Test Units & Sums of Lithics/qcm

FIGURE 9.2

TABLE 9.1

Summary Statistics for Density Variables,
Sites South of Salt Pond

(19BN308, 323, 273/275, 274/339, 340, 341)

Variable	# Observations	$\bar{X}$	s	Maximum Score	Minimum Score
# Lithics/quarter cubic meter	679	55	151	2,826	0
g Total Shell/ quarter cubic meter	615[a]	1,880	10,610	164,845	0
g Fire-cracked Rock/ quarter cubic meter	679	203	1,208	19,328	0

[a] For G4 tests traces of shell were present, but the weights were not recorded. These observations are not included in these statistics.

test units. Of the three variables, lithics/qcm showed the least spread with a standard deviation only 3 times the mean, while for grams of shell/qcm and grams of fire-cracked rock/qcm the standard deviations are respectively 5 and 6 times the mean. As the variable with the narrowest range of scores and, therefore, the greatest risk of inaccuracy from the use of sums, a test of the chosen density measure using lithics/qcm values was desirable and is presented below.

The test of the reliability of using sums as estimates for the density of remains in each concentration was applied using data from two sites: 19BN308 and 323. The total number of lithics for each concentration in these sites was divided by number of quarter cubic meters excavated in them to obtain a value of lithics/qcm for each of the 35 concentrations. This value is a direct measure of the density of remains in a concentration. The values obtained ranged from 5 to 466 lithics/qcm (Figure 9.3). The question to be answered was whether this test technique and the technique using sums identified the same concentrations as having dense deposits of lithics. If both identified the same concentrations, the argument that the use of the sums technique was not biased by variation in the number of test units would be supported.

The top eight scores (approximately the upper 25%) using each technique were compared (Table 9.2). Half of the top listed concentrations hold exactly the same rank using either technique, and all but one concentration on each list occur on both lists. These test results indicate that the bias introduced due to differential testing is not strong and support the use of sums to characterize the density of remains in each concentration.

The distributions of sums of the three density variables for each concentration were inspected to see whether natural breaks existed. Figure 9.4 shows the distribution of scores for the number of lithics/quarter cubic meter among concentrations. It illustrates the type of distribution each of these three variables presented. The display for lithics/qcm and similar displays done for the other two variables show the same pattern; large majorities of the scores for individual concentrations are low, indicating concentrations without dense deposits. Each of the distributions shows a slight but definite increase in the frequency of scores at about the 75th percentile after which the frequencies decrease again with very high scores occurring in the upper tail of the distribution. This pattern suggests that the 75th percentile is a reasonable point at which to begin considering deposits to be "dense" deposits. Such dense deposits are here interpreted as potential secondary deposits.

To test the accuracy of this technique for distinguishing dense deposits, the rank in each distribution for several concentrations that contained subplowzone midden deposits was checked. Such middens appear visually, and from preliminary sorting of their contents, to be very dense deposits of a variety

Frequency	Lithics/ qcm	
2	0*	5,6
7	1	0,1,1,2,3,4,8
5	2	0,3,7,8,8
3	3	0,3,6
2	4	4,8
3	5*	1,8,9
4	6	0,1,6,8
0	7	
1	8	8
0	9	
4	1**	11,32,50,57
2	2**	16,46
0	3**	
2	4**	60,66

FIGURE 9.3: Stem-and-Leaf Diagram, Lithics/qcm for 35 Concentrations, 19BN308 and 323

TABLE 9.2

Comparison of Techniques to Identify Dense Deposits

	Sums of Test Unit Scores				Test Technique		
	Conc.	Rank	Score		Conc.	Rank	Score
**	308.11	1	3747	**	308.11	1	466
**	308.14	2	1647	**	308.14	2	460
*	308.12	3	1470	*	308.51	3	246
**	308.34	4	1310	**	308.34	4	216
**	323.22	5	1000	**	323.22	5	157
	308.21	6	943		323.71	6	150
*	308.33	7	935	*	308.12	7	132
*	308.51	8	920	*	308.33	8	111

Key: ** = exact matches; * = among top scores on both lists

N Lithics/qcm	Number of Concentrations 5 10 15 20 25 30
0-99	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
100-199	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
200-299	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
300-399	XXXXXXXXXXXXXXX
400-499	XXXXXXXXXX
500-599	XXXXX
600-699	XXXXXXX
700-799	XXXXX
800-899	XX
900-999	XXXXXXX
1000-1099	XXXXXX
1100-1199	
1200-1299	XXXX
1300-1399	XXX
1400-1499	XX
1500-1599	
1600-1699	X
1700-1799	X
1800-1899	
1900-1999	XX
2000-2999	XXXX
≥ 3000	XXXXXXXXXX

FIGURE 9.4: Sums of the Number of Lithics/Quarter Cubic Meter
(N = 176 Concentrations, X = one observation)

of materials; very likely they are secondary deposits of trash and garbage. Since the subplowzone midden deposits were truncated by historic plowing, it is expected that the plowzone layers above them should be good indicators of the density of materials in midden deposits that have been disturbed by plowing. Six concentrations with subplowzone midden deposits from four sites south of Salt Pond were checked (Concentrations 308.33, 308.42, 323.22, 274.12, 341.21 and 341.23). Each of these concentrations had scores for their plowzone deposits that were above the 75th percentile for at least two out of the three density variables. This supports the use of the 75th percentile to identify concentrations that include dense deposits of lithics, shell or fire-cracked rock. Table 9.3 lists the concentrations with high density scores and shows the types of materials that occur in them. Of the total of 176 concentrations that were analyzed, 82 contained a high score for at least one variable. Of these, 4 had high scores on all three variables, 39 on 2 of 3, and 39 on a single variable (Table 9.3a).

These dense deposits might reflect secondary deposits. Some of the deposits, particularly those that had high scores for only a single variable, however, might be primary deposits related to an activity or activities that generated dense remains. In order to examine this possibility, the diversity of artifact types found in each concentration is examined in the next section.

Primary vs. Secondary Deposits The Diversity of Materials

Stone artifacts were the most abundant kind of prehistoric remains in the prehistoric assemblages analyzed here. Due to the pervasiveness of the lithic artifacts, and the relative scarcity of other kinds of artifacts, the number of different lithic artifact types in each concentration was used as a variable to determine the diversity of remains in each concentration. Using a combination of raw material and lithic technology types, 23 different artifact types were possible (Table 9.4).

The number of artifact types represented in the assemblage of each concentration was tallied. The results were inspected in an attempt to discover natural breaks in the distribution that might serve as reasonable markers to distinguish relatively diverse from simple assemblages (Figure 9.5). The display of the distribution, however, did not reveal any substantial natural breaks. There is a break in the distribution at the 16 artifact types value and a doubling of the concentration frequency at 17, the 75th percentile. This constitutes a relatively large break in the distribution, albeit not a wide or unique one. Again, however, the 75th percentile seemed a reasonable value to use. In this case, a score of 17 or greater for the number of artifact types was considered to indicate high diversity.

The effect of variation in the number of test units, in this case as expressed by excavated volumes, on the number of artifact

TABLE 9.3: Concentrations with High Density Scores[a]

Conc.	Lithics/ qcm	g Shell/ qcm	g FCR/ qcm	Conc.	Lithics/ qcm	g Shell/ qcm	g FCR/ qcm
308.11	*	*		390.11			*
.12	*	*		.21			*
.14	*	*		.22			*
.15		*		.23			*
.21	*	*		.31	*		*
.22		*		.33		*	*
.26		*	*	.34		*	*
.32		*		.36			*
.33	*	*	*	.37			*
.34	*	*					
.35		*		336.11		*	
.42		*	*	337.11		*	
.51	*		*	336.14		*	*
.52			*				
.71		*		374.21	*		
				.54	*		
323.12			*				
.22	*	*		356.21	*		
.23		*					
				282.23	*		*
273.11		*		.24	*		*
.31			*				
				169.22		*	*
274.12		*	*				
.22			*	281.12	*		
.31		*	*	.13	*		*
				.14	*		*
341.21	*	*	*	.15	*		
.22	*			.22	*		
.23	*	*		.23	*		
.24	*		*	.25			*
				.26			*
288.11		*		.31	*		*
.22		*	*	.33	*		*
.23		*		.34	*		
.31	*	*		.37	*		
.32		*	*	.41	*		*
.33	*	*		.42	*		*
.42		*		.43	*		*
.43		*		.44	*		*
.45	*	*	*	.45	*		*
.51	*	*		.46	*		*
.52	*	*		.47	*		*
.53		*	*	.48	*		
.54		*					
.55	*	*	*				
.56		*					
.57		*					
.58		*					

[a]High density scores are equal to or above the 75th percentile:
number of lithics/qcm = 758; g of shell/qcm = 1649 g; g of fcr/qcm = 1415 g

TABLE 9.3a

Concentrations with Dense Deposits for One or More Variables

High Density Variable(s)	Number of Concentrations
Lithics	10
Shell	17
Fire-cracked Rock	12
Lithics and Shell	11
Lithics and FCR	16
Shell and FCR	12
Lithics, Shell and FCR	4
	82

TABLE 9.4

Artifact Types Used to Compare the Diversity of Deposit Contents

	Lithic Raw Material	Technological Type
1.	chert	-any type
2.	other fine-grained lithic	-any type
3.	any type	-core
4.	quartz	-shatter or block
5.	quartz	-trim flake
6.	quartz	-decortication flake
7.	quartz	-regular or thinning flake
8.	quartz	-biface, uniface or retouched flake
9.	quartzite	-shatter or block
10.	quartzite	-trim flake
11.	quartzite	-decortication flake
12.	quartzite	-regular or thinning flake
13.	quartzite	-biface, uniface or retouched flake
14.	felsite	-shatter or block
15.	felsite	-trim flake
16.	felsite	-decortication flake
17.	felsite	-regular or thinning flake
18.	felsite	-biface, uniface or retouched flake
19.	fine-grained felsite	-shatter or block
20.	fine-grained felsite	-trim flake
21.	fine-grained felsite	-decortification flake
22.	fine-grained felsite	-regular flake and thinning flake
23.	fine-grained felsite	-biface, uniface or retouched flake

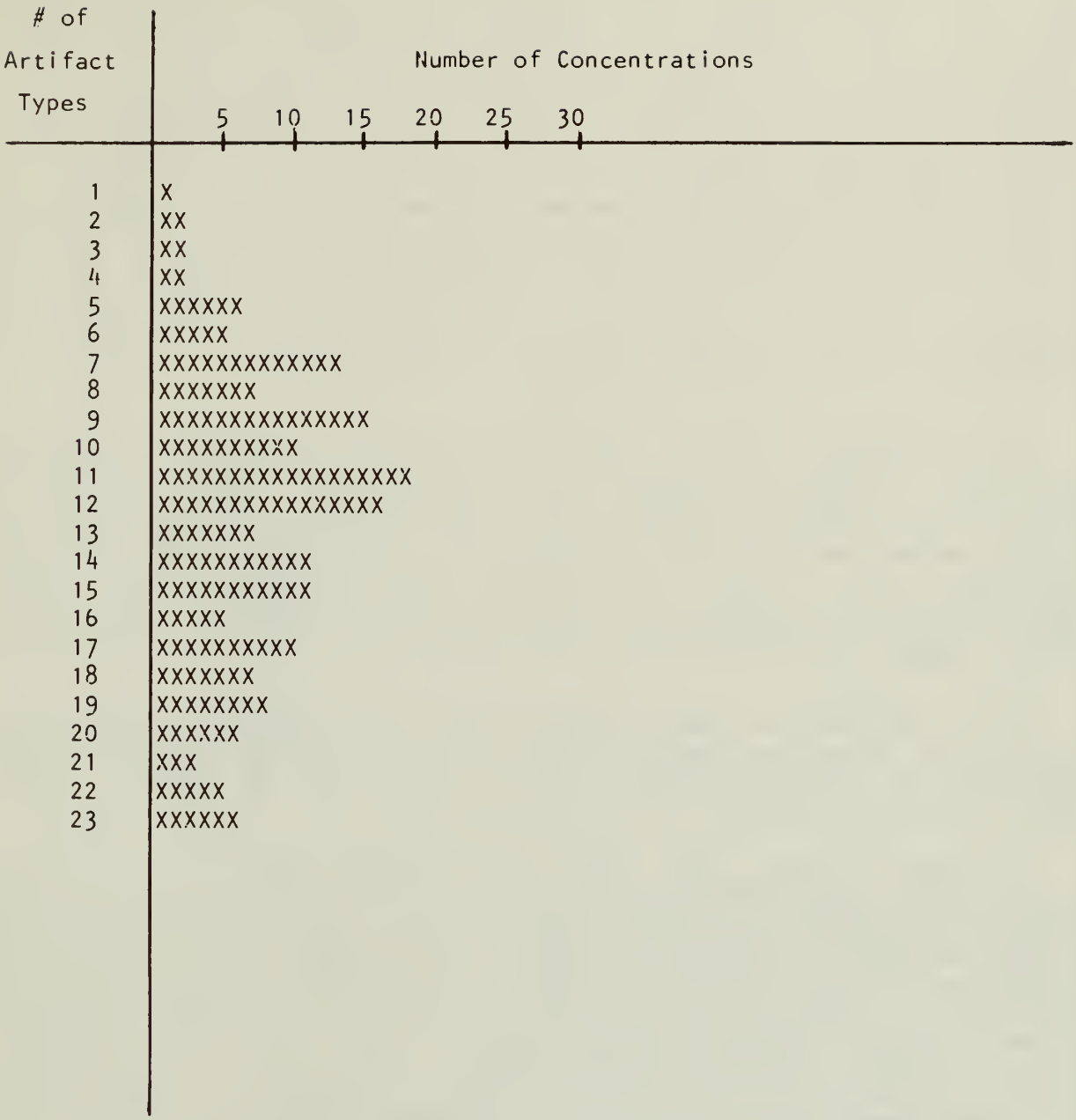


FIGURE 9.5: Number of Artifact Types for Each Concentration

(N = 176, X = one concentration; 25th percentile = 9, Median = 12, 75th percentile = 17)

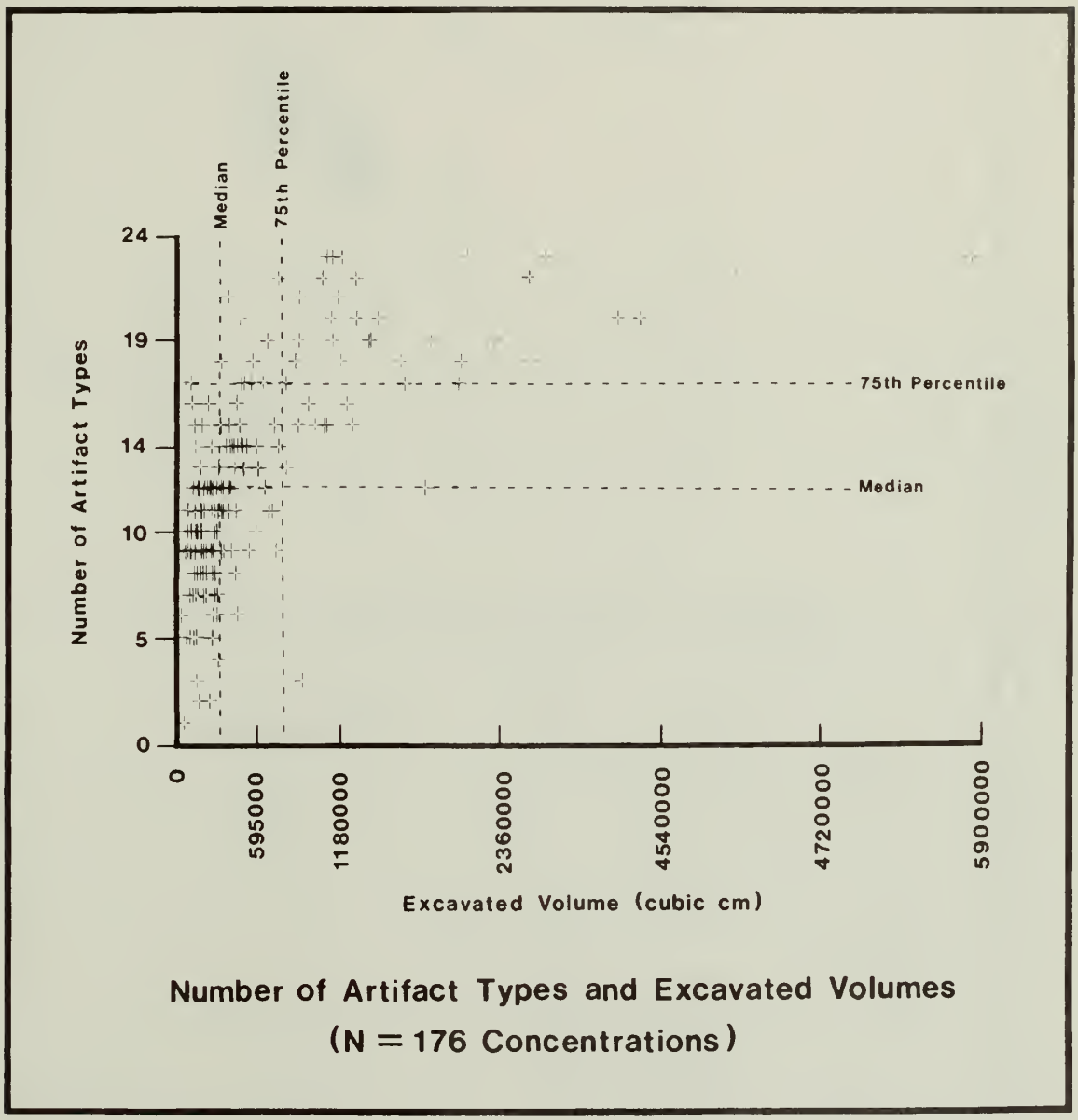
types in concentrations also was checked, and there seemed to be a positive corrrelation. A scatter diagram of concentration values for the number of artifact types and excavated volume indicated a moderate linear correlation (Pearson's r = .632) between these two variables (Figure 9.6). The question to be resolved in light of this was whether the concentrations with greater excavated volumes had higher numbers of artifact types merely because more of their volume was excavated. In Chapter 3 it was pointed out that during the examination of site areas those portions of sites that appeared to have denser and more diverse remains were tested more intensively than others. So, on the other hand, the correlation observed in the scatter diagram might be an accurate depiction of the actual occurrence of different artifact types among the concentrations, unbiased by variation in the excavated volumes.

The easiest way to explore the relationship between excavated volume, number of test units and number of artifact types was to inspect a single site very closely. Using one site area as an example allowed for the consideration of intrasite spatial variation in the diversity of deposits. The spatial variation was the key to solving the problem at hand and was illustrated most easily in the context of a single site area, rather than by considering the entire data set of 17 sites and 177 concentrations.

Site 19BN323 was used because its concentrations encompass nearly the complete range of variation in both excavated volume and number of artifact types. Yet it contains a small enough number of concentrations (9) to make comparisons uncomplicated.

To begin with, note that six concentrations (323.12, .13, .14, .21, .23 and .24) were examined by 2 or 3 excavation units (Table 9.5). Four of these (323.13, .14, .23 and .24) had very similar amounts of excavated volume (ca. 700,000 cubic cm). Yet the number of artifact types found in the concentrations varied from 9 to 19. This variation seems due to the intrasite location of the concentrations (Figure 9.7). Those with the largest number of types (323.21, .22 and .23) are located in the eastern half of the site area, along the southern boundary of sample unit 69. Those with the lowest numbers of types (323.12, .13, .14 and .24) are either peripheral to the former area or set off from it by an area with a very low number of artifact types, 323.15. The highest artifact diversity area within 19BN323 is the portion covered by concentrations 323.21, .22 and .23. Within this limited area Concentration 323.23, which is only sixth among the nine concentrations in excavated volume, contains the second largest number of artifact types.

This example shows that similar excavated volumes and numbers of test units do not in and of themselves result in similar numbers of artifact types. Large excavated volumes do not necessarily mean large numbers of artifact types (e.g., 323.12) and large numbers of artifact types do not necessarily



Number of Artifact Types and Excavated Volumes
(N = 176 Concentrations)

FIGURE 9.6

TABLE 9.5

a. Comparison of Excavated Volume, Number of Test Units and Number of Artifact Types, 19BN323

Concentration	Excavated Volume (cubic cm)	Number of Tests Shovel	EUs	Number of Artifact Types
323.11	282,600	7	0	5
323.12	1,825,340	7	3	12
323.13	733,971	3	2	9
323.14	697,264	6	2	11
323.15	246,176	5	0	2
323.21	1,856,026	4	3	19
323.22	4,087,744	3	6	22
323.23	658,960	1	2	19
323.24	655,000	0	2	12

b. Comparison of Ranks for Excavated Volumes and Number of Artifact Types, 19BN323

Volume	Rank	Number of Artifact Types
323.22	1	323.22
.21	2	.21
.12	3	.23
.13	4	.12
.14	5	.24
.23	6	.14
.24	7	.13
.11	8	.11
.15	9	.15

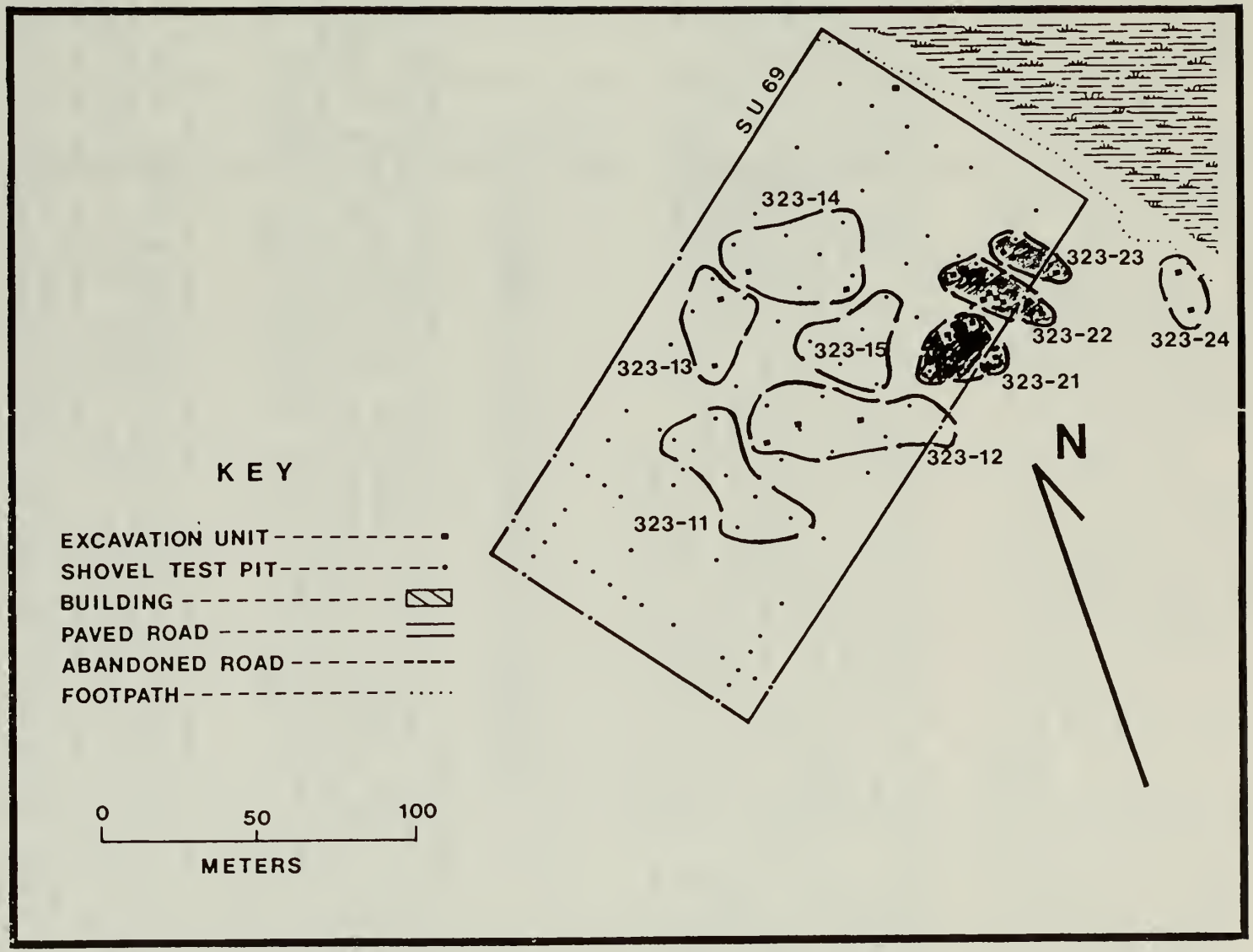


FIGURE 9.7: Concentrations in 19BN323 (Concentrations with high diversity assemblages are shaded)

require large excavated volumes (e.g., 323.23). It is probable that substantial difference in volume can cause some difference in the number of artifact types. If, for example, 323.14 had an excavated volume nearly three times greater than it actually has, would it have 12 rather than 11 artifact types?

This kind of variation, however, requires massive differences in volume for a slight increase in the number of artifact types. In 19BN323, on the other hand, the differences between diverse and nondiverse assemblages in the number of artifact types were substantial. A correlation between the diversity of artifact types and the excavated volume in concentrations was expected. The intrasite sampling design explicitly placed a large portion of test units in areas where initial site examination results indicated that dense and complex deposits existed.

The pattern of 19BN323 and similar patterns in other sites suggested that the number of artifact types in each concentration assemblage was an appropriate measure of the diversity of deposits. Values equal to or greater than the 75th percentile (17) were considered indicators of diverse deposits. In order to check for situations in which very large or very small excavated volumes might have affected a value on either side of the 75th percentile, the associations between the density variables described in the preceding section and concentrations with between 16 and 18 artifact types were checked especially closely during the analysis of deposit types.

Analysis and Comparisons of Deposits

As described in the foregoing sections, density and diversity were used to distinguish primary from secondary deposits. The density of deposits was described by three variables, the sums for each concentration of: (1) the number of lithics, (2) the grams of shell and (3) the grams of fire-cracked rock per quarter cubic meter. The diversity of deposits was measured by the number of lithic artifact types found in each concentration.

Following these guidelines, concentrations with two or three high scores for density variables were tabulated along with the number of artifact types for each (Table 9.6). The excavated volume values for concentrations with values of 16 for the number of lithic types were inspected to determine whether low excavated volume might have kept the lithic types value below the 75th percentile. Initially, volumes for two concentrations at 19BN281 (281.45 and 281.47) were checked. The volumes were markedly low, the former just above and the latter below the 25th percentile (199,479 cubic cm) for the distribution of excavated volume values. Given such low excavated volumes, it seemed possible

TABLE 9.6: Concentrations with Dense Remains for Two or Three Variables

Concentration	Lithics	Shell	Fire-cracked Rock	Number of Artifact Types
308.11	*	*		23
.12	*	*		13
.14	*	*		22
.21	*	*		18
.26		*	*	5
.33	*	*	*	17
.34	*	*		22
.42		*	*	20
.51	*		*	23
323.22	*	*		22
274.12		*	*	23
.31		*	*	15
341.21	*	*	*	23
.23	*	*		22
.24	*		*	23
288.22		*	*	14
.31	*	*		21
.32		*	*	15
.33	*	*		21
.45	*	*	*	12
.51	*	*		17
.52	*	*		21
.53		*	*	14
.55	*	*	*	13
390.31	*		*	
.33		*	*	20
.34		*	*	14
336.14		*	*	

Concentration	Lithics	Shell	Fire-cracked Rock	Number of Lithic Types
356.21	*		*	19
282.23	*		*	19
.24	*		*	20
169.22		*	*	9
281.13	*		*	8
.14	*		*	15
.31	*		*	9
.33	*		*	11
.41	*		*	12
.42	*		*	10
.43	*		*	17
.44	*		*	12
.45	*		*	16
.46	*		*	15
.47	*		*	16

that a lower value for the number of artifact types necessary to consider the assemblage diverse might be justifiable for these concentrations. To make a comparison, excavated volumes for all 19BN281 concentrations with two high density scores and values equal to or greater than the median (12) for number of artifact types were inspected and compared with the high diversity concentrations from 19BN323 (Table 9.7). The simple comparison between these two groups of the number of cubic centimeters per different artifact type indicates that the 19BN281 assemblages are quite a bit more diverse on a per volume basis. While this is no guarantee that larger excavation volumes in the concentrations at 19BN281 would have resulted in larger numbers of types, it does seem sufficient justification for using the median rather than the 75th percentile of the number of artifact types to designate concentration assemblages at 19BN281 as diverse.

Referring to Table 9.6 again, 27 concentrations were identified that have high diversity scores and high density scores for at least two types of remains. These concentrations were considered to contain secondary deposits. This left 14 concentrations on Table 9.6 that had dense deposits of two kinds of remains, but lithic assemblages that were not diverse. In addition, 36 concentrations had dense deposits of one kind of remain and some of these also had diverse lithic assemblages (Table 9.8).

This approach and analysis identified more than a dichotomization of concentrations into those deposits that are secondary and those that are primary. Instead, the concentrations were arranged on a more or less continuous scale from dense and diverse deposits to dispersed and simple ones. To examine how these various characteristics of the deposits relate to prehistoric behavior, it was necessary to consider the activities that could be inferred from the assemblage contents. The next sections of this chapter present an analysis of the lithic assemblages of each concentration. In Chapter 16, information about the deposit characteristics, lithic assemblages, prehistoric ceramics, faunal and floral remains, shellfish remains and fire-cracked rock are combined to identify in more detail the activities represented by each concentration.

Lithic Assemblage Functional Analysis

This section considers the activities represented by the lithic assemblages of each concentration. The lithic assemblages were overwhelmingly chipped stone and, unless otherwise specified, the terms "lithics" and "chipped stone" are used synonymously in this analysis.

The data set for this analysis included the chipped stone assemblages from 176 concentrations. One of the 177

TABLE 9.7

Excavated Volumes and Number of Artifact Types
19BN281 and 323

Concentration	Excavated Volume (cubic cm)	Number of Artifact Types	Cubic Cm/ Artifact Type
281.14	201,455	15	13,430
281.41	202,726	12	16,893
281.43	115,520	17	6,795
281.44	124,402	12	10,366
281.45	232,008	16	14,500
281.46	135,048	15	9,003
281.47	118,500	16	7,406
323.21	1,856,026	19	97,685
323.22	4,087,744	22	185,806
323.23	658,960	19	34,682

TABLE 9.8: Concentrations with Dense Remains for a Single Variable

Concentration	Lithics	Shell	Fire-cracked Rock	Number of Artifact Types
341.22	*			18
374.21	*			19
.54	*			23
281.12	*			7
.15	*			7
.22	*			9
.23	*			8
.34	*			11
.37	*			12
.48	*			14
308.15		*		11
.22		*		15
.32		*		6
.35		*		7
.71		*		18
273.11		*		12
288.11		*		15
.23		*		7
.42		*		17
.43		*		10
.54		*		11
.56		*		10
.57		*		13
.58		*		2
336.11		*		20
337.11		*		16
308.52			*	17
323.12			*	12
.23			*	19
273.31			*	20
274.22			*	19
390.11			*	9
.21			*	12
.22			*	16
.23			*	4
.36			*	14
.37			*	14
281.25			*	7
.26			*	12

concentrations identified in Chapter 3 contained no lithic artifacts, so the lithic analysis included only 176 assemblages. The assemblages contained between 3 and 4157 artifacts (mean = 292, median = 79, 75th percentile = 252). Artifact categories, based upon combinations of lithic raw material and technology, were used to describe the assemblages initially. The technological categories rather than the lithic raw material categories will receive the bulk of the attention in this section.

Ten artifact categories based upon technological characteristics were used originally to classify the lithic artifacts (Table 9.9). Due to very small frequencies of occurrence, two of the categories, retouched flakes and unifaces, were combined for analysis. As part of the basic cataloging for the survey, additional typological information was recorded for bifaces; however, that information was not used for this analysis. For this analysis the categories "shatter" and "block" also were combined because they are indicators of the same activities.

These artifact categories, based upon technological characteristics, were chosen for this analysis for three reasons. First, they were easily recognized and differentiated and, therefore, could be grouped, coded and counted quickly. Second, they occurred frequently enough in assemblages to make quantitative analysis possible. Finally, differences among assemblages in the relative frequencies of these categories can be linked to different manufacturing, use and maintenance activities. The artifact-activity correlates (Schiffer 1976:14, 93) are discussed in the next section.

Artifact Activity Correlates

The relative frequency of bifaces in an assemblage can reflect the importance of several activities. Middle or late stages of lithic manufacturing can be represented by bifaces discarded because of breakage or flaws. Finished bifaces represent a considerable expenditure of energy; their discard was probably a rare event. An accumulation of bifaces discarded because they were no longer useful and could not be rejuvenated is more likely at a location used for an extended period. Binford (1979:269-270) argues that personal or household gear, such as bifacial tools "...are apt to be both produced and maintained within residential sites, resulting in an association [of] such locations...[with the] final discard of worn-out items." The present analysis is insufficiently detailed to distinguish between flawed, partially manufactured bifaces and exhausted, finished ones. Here, the occurrence of bifaces was interpreted to mean the occurrence of later stages of lithic manufacturing and/or lithic tool maintenance.

TABLE 9.9: Lithic Artifact Categories

1. Trim Flake
   Any flake which fits completely inside a 2 x 2 cm square is considered a trim flake. Any orientation is allowed, but fit is not forced. If the flake is not whole, it is considered a trim flake unless the cataloger is fairly confident that it would have been bigger than 2 x 2 cm. Trim flakes are fairly thin and tend to feather out at the edges, but they don't necessarily have a distinct bulb of percussion or striking platform. Thus, the trim flake category includes small "chips," but not "chunks."

2. Regular Flake
   Fragment of rock removed from a core or large biface by the application of force by a toolmaker. Flakes display most of the following characteristics:
   1) Dorsal surface: these have cortex or flake scars or both;
   2) Ventral surface: these have a bulb of percussion; concentric ripples emanating from point of force; bulbar scars; bulbar surfaces are relatively smooth;
   3) Striking platform: a relatively flat, often oval, area. Tiny flake scars or grinding may occur along the dorsal edge of the platform. All or part of the platform may have collapsed when the flake was removed and, therefore, not be present on the flake.

3. Shatter
   A specimen with the morphological characteristics of a block that fits inside a 2 x 2 cm square is considered shatter.

4. Block
   A thick angular specimen that:
   1) lacks well-defined striking platform;
   2) lacks the identifiable dorsal and ventral surfaces of a flake;
   3) can't be oriented as a flake as to direction from which force was applied to remove specimen from nodule or core.

   Debitage of quartz is most frequently classified as block and shatter. Flakes may be thick and have angular cross sections but if striking platform, dorsal, and ventral surfaces, or orientation can be determined, the specimen is considered a flake, not block or shatter. Thin pieces of debitage without distinct striking platform or other characteristics allowing orientation are still considered flakes.

5. Decortication Flake
   A flake with any amount of cortex on the dorsal surface is considered a decortication flake.

6. Thinning Flake
   This category has several morphological characteristics, not all of which need be present on each specimen. These criteria are roughly in priority order:
   1) the angle between the plane of the platform and the dorsal face is considerably smaller than 90°. The angle should be less than 60°for a flake to be considered a thinning flake. If the angle is greater than 60° but criteria 2, 3, and 4 are met, the flake may be considered a thinning flake;
   2) the striking platform is faceted, i.e., it contains small remnants of flake scars;
   3) thin cross sections and spatulate plan, the bulb of force is often indistinct;
   4) broad flake scars on dorsal surface, indicating the previous removal of other thinning flakes;
   5) sometimes a lip on the ventral edge of the striking platform;
   6) platforms are sometimes much narrower than the maximum width of the flake.

7. Core
   Multiface piece with large and relatively deep, possible systematic, flake scars indicating removal of a series of large flakes. Cores may have more than one platform and may be flaked in more than a single direction. The systematic removal of flakes to produce flakes of a relatively large size and/or consistent shape is another characteristic of a core. Flake scars are large 2, typically greater than (2 cm in length).

8. Retouched Flake
   Distinguished from unifaces on the basis of the extent and size of the edge modification which is scalar, systematic, and intentional, but does not extend to near mid-line of the specimen.

9. Uniface
   Specimen has regular thinning and edge-shaping flake scars on one face. Flake scars are regular and relatively large extending well onto the face of the specimen.

10. Biface
    Completely thinned piece that is mostly or completely shaped. Included in this category are pieces typically classified as tools and preforms.

Flakes are a common occurrence in most prehistoric assemblages in the Northeast. They can be created in abundance by chipped stone manufacturing and they probably were used for a wide variety of tasks (e.g., Bordaz 1970:45-46; Gould 1980:121-137, Gould et al. 1971; White and Thomas 1972). High relative frequencies of regular flakes were interpreted to mean the occurrence of primary lithic manufacturing, including the earliest stages of bifacial shaping.

Decortication flakes are those with cortex on all or part of the dorsal face. The raw materials used for chipped stone tools on outer Cape Cod were predominantly cobbles from glacial outwash plains and moraines. Primary maufacturing of bifaces, unifaces or flakes from cobbles required the removal of the cortex, the surface of the cobble. The flakes detached during the primary manufacturing activity are decortication flakes; the cobbles from which they are detached become cores. The cores were either thinned and shaped into bifaces or abandoned after the removal of a series of flakes. Relatively high percentages of decortication flakes and cores were taken as indicators of substantial primary manufacturing activity.

Flakes less than 2 cm in length and width were referred to as trim flakes. They result from the final shaping and thinning of bifaces or unifaces and the rejuvenation of tool edges blunted by use. High relative frequencies of trim flakes were interpreted as indicating late stage manufacturing or lithic tool maintenance activities.

Blocks and shatter are chunky pieces often generated during primary manufacturing. Size is the only difference between them: shatter is less than 2 cm in length and width and blocks are greater than 2 cm. The less homogeneous the raw material, and the more cleavage planes a cobble had, the greater the amount of shatter and blocks expected. Lithic manufacturing, particularly primary manufacturing, is suggested by high percentages of these types when fine grain homogeneous raw materials are used. Large grain raw materials, such as quartz, are likely to have produced blocks and shatter at all manufacturing stages and for rejuvenation as well.

This is a comparative approach to the interpretation of the activities that are represented by the chipped stone remains. The discussion above describes how relative frequencies of various artifact categories reflect different kinds of activities. The next step was the examination of variation among the assemblages in the relative frequencies of the artifact categories.

Assemblage Frequency Distributions

Due to the wide variation in the number of lithic artifacts, relative rather than actual frequencies were used for the

assemblage comparisons. Percentages can be very useful standardized measures for comparing assemblages of markedly different sizes; however, there is a danger that assemblages with small numbers of artifacts will produce percentages that are affected substantially by small sample size. To investigate this possibility, the examination of distributions for each artifact category differentiated between assemblages that had fewer and greater than 100 lithic artifacts; no assemblages contained exactly 100 artifacts.

A series of histograms (Figures 9.8-9.11) were drawn so that the distributions could be inspected visually, as well as by means of the summary statistics (Table 9.10). Since relatively few of the assemblages contained thinning flakes, bifaces, cores, unifaces or retouched flakes, histograms were not done for these categories. The figures illustrate the distributions of relative frequencies of trim flakes (Figure 9.8), regular flakes (Figure 9.9), shatter and blocks (Figure 9.10) and decortication flakes (Figure 9.11) among the 176 concentration assemblages analyzed. They also show the differences within these distributions between assemblages with less than 100 artifacts (98 assemblages) and those with more than 100 (78 assemblages). For all of the categories displayed the distributions of the smaller assemblages had relative frequencies that are substantially more widely dispersed than the larger assemblages. Relative frequencies for the larger assemblages were much more congruent with the measures of central tendency for all concentrations (Table 9.10), even though they comprised less than half (44%) of the total number of assemblages.

Table 9.11 shows numerically the differences between the smaller and larger assemblages in relative frequencies for 5% increments in the distributions of the four artifact categories for which displays were done. The percentages from assemblages with fewer than 100 were less precise indicators of the distributions' central tendencies. This suggested that they also were less accurate reflectors of the actual relative frequencies of artifact categories in the complete concentration assemblages. The remainder of this analysis, therefore, concentrated on assemblages with more than 100 artifacts.

As in the preceding sections, the definition of high and low scores had to be faced here. Again order statistics seem more appropriate than the mean and an increment of the standard deviation. The anomalously high and low scores in each distribution affect the mean and standard deviation much more than the median, 25th and 75th percentiles are affected. This effect is especially apparent for the categories that are rare (Table 9.10), for which the standard deviation is several times greater than the mean.

Once again, the distributions were compared in order to identify anomalously high scores and anomalously low scores that might, singly or in combination, suggest one or more of the

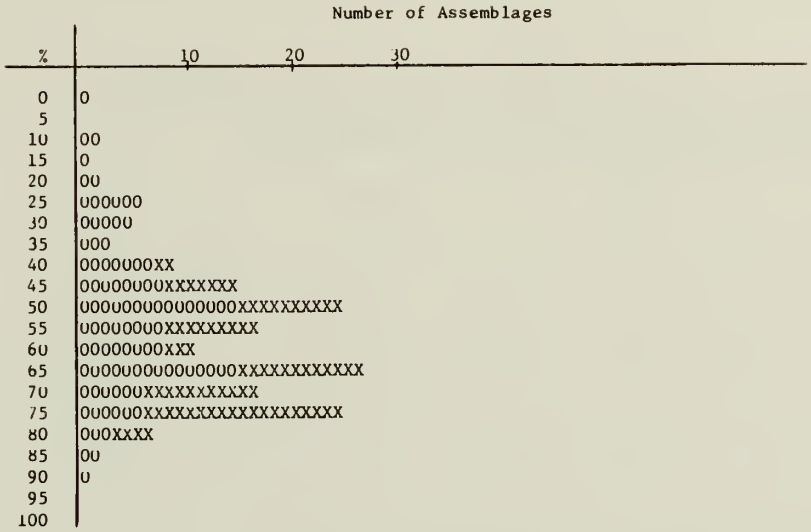


FIGURE 9.8: Distribution of Percentages of Trim Flakes
(N=176; U = assemblages <100, X = assemblages >100)

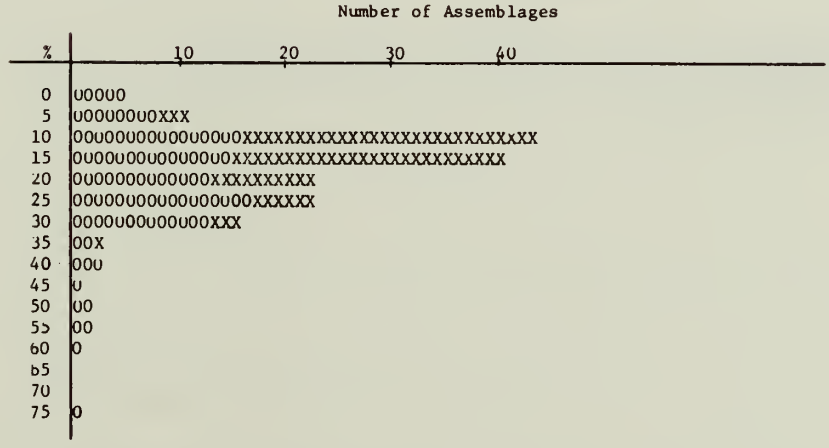


FIGURE 9.9: Distribution of Percentages of Regular Flakes
(N = 176; 0 = assemblages <100, X = assemblages >100)

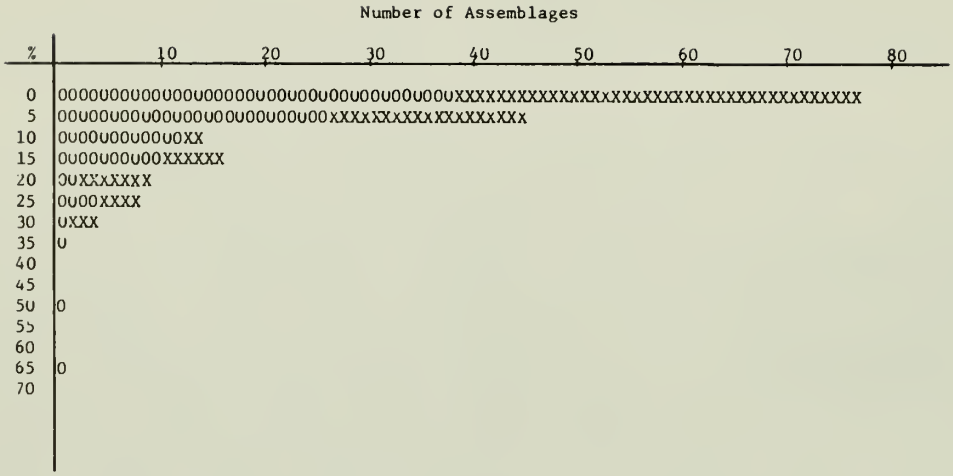


FIGURE 9.10: Distribution of Percentages of Shatter and Blocks
(N = 176; U = assemblages <10U, X = assemblages >10U)

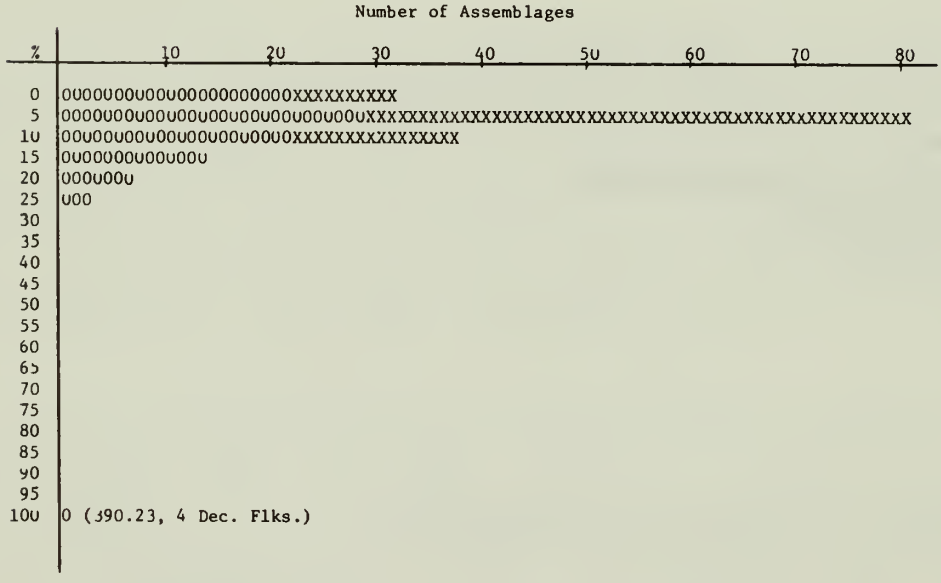


FIGURE 9.11: Distribution of Percentages of Decortication Flakes
(N = 176; O = assemblages <10O, X = assemblages >10O)

TABLE 9.10: Summary Statistics of Relative Frequencies Distributions (N=176 Assemblages)

Artifact Category	$\bar{X}$	S	Percentiles 25th	75th	Median	Maximum	Mimimum
Total Number of Lithics	292	584	32	252	79	4158	3
Trim Flakes	58.8%	16.6%	49.2%	72.2%	60.0%	91.4%	0.0
Regular Flakes	20.6%	11.3%	13.2%	26.8%	18.3%	75.0%	0.0
Shatter and Blocks	9.1%	10.2%	2.5%	12.2%	5.6%	66.7%	0.0
Decortication Flakes	9.2%	8.8%	5.2%	11.1%	7.7%	100.0%	0.0
Thinning Flakes	.6%	1.6%	0.0	.2%	0.0	14.3%	0.0
Bifaces	1.3%	3.3%	0.0	1.1%	.3%	33.3%	0.0
Cores	.2%	1.1%	0.0	0.0	0.0	14.3%	0.0
Unifaces and Retouched Flakes	.04%	.3%	0.0	0.0	0.0	3.8%	0.0

TABLE 9.11: Comparisons of Relative Frequencies Distributions and Assemblage Sizes

Artifact Type	Assemblage Size	Percentage Ranges for Distributions																
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80
Trim Flakes	>100 N=78	-	-	-	-	-	-	-	-	3%	9%	13%	11%	4%	15%	14%	24%	5%
	<100 N=98	1%	-	2%	1%	2%	6%	5%	3%	7%	8%	15%	8%	8%	15%	6%	6%	6%
Regular Flakes	>100 N-78	-	4%	36%	33%	13%	8%	4%	1%	-	-	-	-	-	-	-	-	-
	<100 N=98	5%	8%	16%	15%	13%	17%	13%	2%	3%	1%	2%	2%	1%	-	-	1%	-
Shatter and Blocks	>100 N=78	50%	24%	3%	8%	9%	5%	4%	-	-	-	-	-	-	-	-	-	-
	<100 N-98	39%	26%	12%	10%	2%	4%	1%	-	-	-	1%	-	-	1%	-	-	-
Decortication Flakes	>100 N=78	13%	67%	20%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<100 N=98	22%	30%	22%	14%	7%	3%	1%	-	-	-	-	-	-	-	-	-	-

NOTE: Percentage may total to slightly less or greater than 100 due to rounding

activities discussed in the preceding section. The order statistics provide more precise indicators of what scores really are high or low given the different distributions. Therefore, the 75th percentile was selected as the indicator of high scores and the 25th as the indicator of low scores (Table 9.12). Of course the simple presence of any of these lithic artifacts indicates that some kind of activity occurred. Moderate scores on various categories are taken to imply that the various associated activities occurred regularly. The emphasis on high or low scores is an attempt to determine which activities predominated.

Admittedly, this approach assumes somewhat standard, mechanical relationships between artifact frequencies and the intensity or duration of activities. This seems contrary to at least some of what is known about lithic tool manufacture and use. It is known generally, for example, that similar artifacts can be generated by different activities. Usually the activities produce the artifacts in different frequencies. With detailed, quantitative information of this sort, and undisturbed deposits, it would be possible to be far more specific about the extent of different kinds of activities based upon the artifacts recovered. In the absence of both these criteria for the analysis of these data, however, the more general interpretations of activities are required. This approach, nonetheless, provides a general picture of the quantitative and spatial variation in the activities associated with lithic use, maintenance and manufacture.

The relative frequencies for all technological artifact categories from all 176 concentration assemblages are given in Table 9.13. These data were reduced by considering only the large (>100 artifacts) assemblages and by distilling the actual percentages into notations of high, moderate or low scores (Table 9.14). Even this matrix presented an imposing series of columns and rows for interpretation. Some patterns of artifact occurrence were identified that could be linked to general lithic manufacturing and maintenance activities (Table 9.15). Note that this table was geared to the archeological remnants that would have been associated with the various activities rather than to all the tools or perishable products that might have been involved in systemic context. Furthermore, similar scores for several categories could possibly be associated with more than one activity. For the present analysis the aim was to identify the lithic manufacturing or maintenance activity or activities that contributed predominately to each assemblage.

There were interesting variations among the sites in the types and variety of activities represented. The lithic assemblages in concentrations at 19BN308, 274 and 341 represented relatively wide ranges of manufacturing and maintenance activities. Assemblages at 19BN390, 333, 336 and 337 suggested only late stage lithic manufacturing and lithic tool maintenance. Assemblages at 19BN374 suggested a strong focus on late stage lithic manufacture.

TABLE 9.12: Values Used to Indicate Anomalously Low or High Scores

Artifact Category	Low Scores	High Scores
Trim Flakes	<49%	>72%
Regular Flakes	<13%	>26%
Shatter and Blocks	< 2%	>12%
Decortication Flakes	< 5%	>11%
Thinning Flakes	-	> .2%
Bifaces	-	> 1%
Cores	-	> 0.0%
Unifaces and Retouched Flakes	-	> 0.0%

TABLE 9.13

Percentages of Technology Types

Concentr#	N Lithics	%TrimFlks	%RegulFlks	%ShatBlks	%DecorFlks	%ThinFlks	%Bifaces	%Cores	%UnifARetF
308.11000	2067.00000	77.50363	13.25593	2.85438	5.37010	.04838	.19400	.04838	09676
308.12000	229.00000	75.54585	15.72052	1.74672	6.98690	0.00000	0.00000	0.00000	0.00000
308.13000	35.00000	82.85714	8.57143	2.85714	2.85714	2.85714	0.00000	0.00000	0.00000
308.14000	1954.00000	74.46264	15.14841	4.70829	5.01535	0.00000	.15400	0.00000	05118
308.15000	93.00000	68.81720	22.58065	1.07527	7.52688	0.00000	0.00000	0.00000	0.00000
308.16000	26.00000	76.92308	11.53846	0.00000	11.53846	0.00000	0.00000	0.00000	0.00000
308.21000	167.00000	65.26946	19.16168	1.79641	12.57485	0.00000	1.20000	0.00000	0.00000
308.22000	115.00000	76.52174	13.04348	4.34783	5.21739	0.00000	.87000	0.00000	0.00000
308.23000	48.00000	83.33333	6.25000	0.00000	10.41667	0.00000	0.00000	0.00000	0.00000
308.24000	119.00000	54.62185	31.09244	5.88235	7.56303	0.00000	.84000	0.00000	0.00000
308.25000	38.00000	28.94737	52.63158	2.63158	15.78947	0.00000	0.00000	0.00000	0.00000
308.26000	12.00000	25.00000	58.33333	0.00000	8.33333	0.00000	8.33000	0.00000	0.00000
308.27000	26.00000	57.69231	19.23077	7.69231	15.38462	0.00000	0.00000	0.00000	0.00000
308.31000	18.00000	50.00000	27.77778	5.55556	16.66667	0.00000	0.00000	0.00000	0.00000
308.32000	35.00000	91.42857	2.85714	0.00000	5.71429	0.00000	0.00000	0.00000	0.00000
308.33000	209.00000	74.16268	14.35407	.95694	8.13397	.47847	.95700	.47847	95694
308.34000	636.00000	70.91195	17.76730	3.45912	6.91824	0.00000	.62900	.15723	0.00000
308.35000	32.00000	78.12500	12.50000	0.00000	9.37500	0.00000	0.00000	0.00000	0.00000
308.41000	260.00000	65.76923	13.46154	5.38462	12.69231	0.00000	2.31000	0.00000	0.00000
300.42000	691.00000	64.68886	21.56295	4.19682	7.81476	.57887	.72400	0.00000	0.00000
308.43000	267.00000	65.16854	22.84644	3.37079	5.99251	0.00000	.74900	.37453	0.00000
308.51000	1125.00000	78.48889	12.00000	3.02222	4.26667	1.51111	.26700	.17778	0.00000
308.52000	87.00000	31.03448	32.18391	11.49425	20.68966	1.14943	2.30000	1.14943	0.00000
308.61000	12.00000	25.00000	33.33333	16.66667	25.00000	0.00000	0.00000	0.00000	0.00000
308.71000	218.00000	50.91743	28.89908	8.25688	8.71560	.91743	.91700	1.37615	0.00000
308.72000	58.00000	36.20690	31.03448	10.34483	20.68966	0.00000	0.00000	0.00000	1.72414
323.11000	7.00000	28.57143	42.85714	28.57143	0.00000	0.00000	0.00000	0.00000	0.00000
323.12000	72.00000	65.27778	20.83333	1.38889	11.11111	0.00000	1.39000	0.00000	0.00000
323.13000	35.00000	62.85714	20.00000	2.85714	14.28571	0.00000	0.00000	0.00000	0.00000
323.14000	37.00000	56.75676	32.43243	2.70270	8.10811	0.00000	0.00000	0.00000	0.00000
323.15000	5.00000	40.00000	60.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
323.21000	488.00000	75.20492	14.13934	1.02459	7.58197	0.00000	.82000	.20492	0.00000
323.22000	2569.00000	82.71701	10.08174	1.67380	4.90463	.11678	.15600	0.00000	0.00000
323.23000	231.00000	67.09957	20.77922	1.73160	7.79221	.86580	.43300	0.00000	0.00000
323.24000	53.00000	79.24528	13.20755	0.00000	5.66038	0.00000	1.89000	0.00000	0.00000
273.11000	32.00000	34.37500	37.50000	9.37500	12.50000	0.00000	6.25000	0.00000	0.00000
273.12000	50.00000	50.00000	24.00000	8.00000	14.00000	4.00000	0.00000	0.00000	0.00000
273.13000	6.00000	33.33333	50.00000	0.00000	16.66667	0.00000	0.00000	0.00000	0.00000
273.21000	29.00000	68.96552	20.68966	3.44828	6.89655	0.00000	0.00000	0.00000	0.00000
273.31000	237.50000	69.68421	16.63158	3.36842	7.78947	2.52632	.42100	0.00000	0.00000
273.32000	33.00000	54.54545	27.27273	6.06061	6.06061	6.06061	0.00000	0.00000	0.00000
274.11000	34.00000	73.52941	11.76471	11.76471	0.00000	0.00000	2.94000	0.00000	0.00000
274.12000	2139.00000	64.65638	18.41982	5.28284	9.53717	.14025	.42100	.09350	.28050
274.13000	133.00000	51.87970	33.08271	8.27068	3.00752	0.00000	1.50000	0.00000	0.00000
274.21000	12.00000	41.66667	33.33333	8.33333	8.33333	0.00000	8.33000	0.00000	0.00000
274.22000	212.00000	50.47170	26.41509	8.96226	9.90566	1.88679	1.42000	0.00000	0.00000
274.31000	56.00000	41.07143	30.35714	7.14286	17.85714	1.78571	1.79000	0.00000	0.00000
274.32000	3.00000	33.33333	33.33333	0.00000	0.00000	0.00000	33.30000	0.00000	0.00000
274.41000	10.00000	50.00000	20.00000	10.00000	20.00000	0.00000	0.00000	0.00000	0.00000
340.11000	13.00000	38.46154	30.76923	7.69231	23.07692	0.00000	0.00000	0.00000	0.00000

TABLE 9.13: Continued, page 2

Concentr$	N Lithics	%TrimFlks	%RegulFlks	%Shat&Blks	%DecorFlks	%ThinFlks	%Bifaces	%Cores	%UnifARetF
288.57000	94.00000	69.14894	18.08511	3.1914	9.57447	0 00000	0 00000	0 00000	0 00000
288.58000	3.00000	66.66667	33.33333	0.0000	0 00000	0.00000	0.00000	0.00000	0 00000
288.61000	25.00000	60.00000	12.00000	16.0000	12.00000	0.00000	0.00000	0.00000	0.00000
288.62000	12.00000	50.00000	8.33333	16.6666	16.66667	0.00000	8.33000	0.00000	0.00000
288.63000	116.00000	69.82759	15.51724	6.0344	6.89655	0.00000	1.72000	0.00000	0 00000
374.11000	517.00000	42.35977	37.52418	5.9961	10.25145	2.90135	.58000	0.00000	0 00000
374.21000	1415.00000	56.11307	23.67491	7.0671	11.02473	1.55477	.35300	0 00000	.07067
374.22000	11.00000	72.72727	18.18182	0.0000	9.09091	0.00000	0.00000	0.00000	0 00000
374.23000	34.00000	47.05882	29.41176	5.8823	17.64706	0.00000	0.00000	0 00000	0 00000
374.31000	82.00000	51.21951	29.26829	1.2195	14.63415	1.21951	2.44000	0.00000	0.00000
374.32000	11.00000	45.45455	27.27273	0.0000	27.27273	0.00000	0.00000	0 00000	0 00000
374.41000	32.00000	59.37500	18.75000	6.2500	9.37500	0.00000	6.25000	0 00000	0 00000
374.42000	15.00000	53.33333	20.00000	6.6666	13.33333	6.66667	0.00000	0.00000	0 00000
374.43000	350.00000	50.00000	28.85714	7.7142	10.57143	1.42857	1 14000	0 00000	0 00000
374.44000	64.00000	51.56250	26.56250	4.6875	14.06250	3.12500	0.00000	0.00000	0 00000
374.45000	302.00000	57.61589	28.47682	3.3112	9.60265	.66225	0.00000	0 00000	0 00000
374.46000	466.00000	55.36481	27.68240	6.4377	9.44206	.42918	.42900	0.00000	0 00000
374.47000	29.00000	44.82759	31.03448	3.4482	17.24138	3.44828	0.00000	0.00000	0 00000
374.51000	201.00000	58.70647	23.38308	6.4676	8.95522	.49751	.49800	0.00000	0 00000
374.52000	40.00000	40.00000	37.50000	0.0000	22.50000	0.00000	0.00000	0 00000	0 00000
374.53000	41.00000	53.65854	26.82927	4.8780	7.31707	7.31707	0.00000	0.00000	0 00000
374.54000	612.00000	55.71895	27.77778	3.7581	12.25490	.32680	.16300	0.00000	0 00000
374.55000	67.00000	47.76119	31.34328	5.9701	13.43284	1.49254	0.00000	0 00000	0 00000
374.56000	56.00000	71.42857	17.85714	1.7857	7.14286	0.00000	1.79000	0.00000	0.00000
374.57000	14.00000	57.14286	0.00000	0.0000	21.42857	14.28571	7.14000	0.00000	0 00000
374.61000	38.00000	60.52632	21.05263	2.6315	10.52632	2.63158	2.63000	0 00000	0 00000
374.62000	27.00000	59.25926	29.62963	7.4074	3.70370	0.00000	3.70000	0.00000	0 00000
374.63000	87.00000	55.17241	20.68966	12.6436	10.34483	0.00000	1.15000	0.00000	0.00000
374.71000	41.00000	46.34146	26.82927	17.0731	9 75610	0.00000	0.00000	0 00000	0 00000
374.81000	57.00000	54.38596	24.56140	8.7719	12.28070	0.00000	0.00000	0.00000	0 00000
281.11000	81.00000	44.44444	9.87654	37.0370	6.17284	0.00000	1 23000	0.00000	0 00000
281.12000	508.00000	53.54331	15.55118	25.9842	4.92126	0.00000	0.00000	0.00000	0 00000
281.13000	539.00000	48.42301	16.51206	22.8200	10.01855	2.22635	.92800	0.00000	0 00000
281.14000	314.00000	48.40764	17.51592	23.2484	9.87261	.31847	.31800	0 00000	0 00000
281.15000	164.00000	48.17073	15.24390	29.2682	5.48780	0.00000	1.22000	0.00000	0 00000
281.21000	7.00000	42.85714	14.28571	0.0000	14.28571	0.00000	14.30000	0.00000	0 00000
281.22000	137.00000	53.28467	10.94891	21.1678	11.67883	0.00000	1.46000	0.00000	0 00000
281.23000	107.00000	45.79439	12.14953	33.6448	6.54206	.93458	.93500	0.00000	0 00000
281.24000	86.00000	45.34884	15.11628	26.7441	11.62791	0.00000	1.16000	0.00000	0 00000
281.25000	106.00000	45.28302	14.15094	25.4717	12.26415	0.00000	1.89000	0.00000	0 00000
281.26000	41.00000	19.51220	7.31707	53.6585	14.63415	2.43902	4.88000	0 00000	0 00000
281.31000	149.00000	53.02013	20.13423	18.1208	7.38255	0.00000	1.34000	0.00000	0 00000
281.32000	62.00000	35.48387	20.96774	29.0322	11.29032	0.00000	1.61000	0 00000	0 00000
281.33000	494.00000	62.55061	11.53846	18.4210	6.68016	0.00000	.81000	0 00000	0.00000
281.34000	177.00000	54.23729	17.51412	16.9491	9.60452	0.00000	.56500	0.00000	0 00000
281.35000	29.00000	44.82759	27.58621	17.2413	6.89655	0.00000	0.00000	0 00000	0 00000
281.36000	29.00000	62.06897	24.13793	10.3448	3.44828	0.00000	0.00000	0 00000	0 00000
281.37000	96.00000	52.08333	18.75000	21.8750	7.29167	0.00000	1.04000	0.00000	0 00000
281.38000	24.00000	20.83333	8.33333	66.6666	0.00000	0.00000	4.17000	0 00000	0 00000
281.39000	60.00000	51.66667	18.33333	15.0000	15.00000	0.00000	0.00000	0.00000	0 00000

TABLE 9.13: Continued, page 3

Concentr#	N Lithics	%TrimFlks	%RegulFlks	%Shat&Blks	%DecorFlks	%ThinFlks	%Bifaces	%Cores	%Unif&RetF
340.12000	18.00000	66.66667	27.77778	5.55556	0.00000	0.00000	0.00000	0.00000	0.00000
340.13000	19.00000	57.89474	26.31579	5.26316	0.00000	0.00000	5.26000	0.00000	0.00000
340.21000	26.00000	53.84615	23.07692	11.53846	7.69231	0.00000	0.00000	0.00000	3.84615
340.22000	61.00000	26.22951	42.62295	24.59016	4.91803	0.00000	0.00000	1.63934	0.00000
341.11000	56.00000	46.42857	28.57143	5.35714	19.64286	0.00000	0.00000	0.00000	0.00000
341.21000	2717.00000	77.84321	12.14575	3.31248	5.74163	.33125	.14700	.03681	0.00000
341.22000	311.00000	65.59486	19.29260	8.68167	6.10932	0.00000	.32200	0.00000	0.00000
341.23000	3107.00000	77.53460	15.83521	.99775	5.02092	.25748	.12900	0.00000	.03219
341.24000	4157.80000	78.28659	12.64611	1.41902	5.95507	1.09192	.09620	.09620	0.00000
341.25000	36.00000	52.77778	27.77778	5.55556	11.11111	0.00000	2.78000	0.00000	0.00000
341.26000	65.00000	44.61538	18.46154	21.53846	15.38462	0.00000	0.00000	0.00000	0.00000
341.27000	65.00000	60.00000	24.61538	3.07692	12.30769	0.00000	0.00000	0.00000	0.00000
333.11000	446.00000	78.02691	12.55605	2.01794	5.82960	0.00000	.89700	0.00000	0.00000
333.12000	4.00000	75.00000	25.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
336.11000	274.00000	81.75182	12.04380	2.18978	2.18978	0.00000	.36500	0.00000	0.00000
336.12000	241.00000	77.59336	16.18257	.82988	4.97925	.41494	0.00000	0.00000	0.00000
336.13000	15.00000	66.66667	13.33333	6.66667	6.66667	6.66667	0.00000	0.00000	0.00000
336.14000	719.00000	82.47566	11.82197	1.25174	4.17246	0.00000	.27800	0.00000	0.00000
337.11000	238.00000	78.15126	13.02521	2.52101	5.88235	0.00000	.42000	0.00000	0.00000
390.11000	7.00000	14.28571	14.28571	28.57143	28.57143	0.00000	14.30000	0.00000	0.00000
390.12000	19.00000	26.31579	47.36842	15.78947	10.52632	0.00000	0.00000	0.00000	0.00000
390 21000	48.00000	62.50000	12.50000	18.75000	6.25000	0.00000	0.00000	2.08333	0.00000
390.22000	87.00000	65.51724	19.54023	9.19540	3.44828	0.00000	1.15000	0.00000	0.00000
390.23000	4.00000	0.00000	0.00000	0.00000	100.00000	0.00000	0.00000	0.00000	0.00000
390.31000	102.00000	72.54902	14.70588	2.94118	9.80392	0.00000	0.00000	0.00000	0.00000
390.32000	13.00000	69.23077	15.38462	0.00000	15.38462	0.00000	0.00000	0.00000	0.00000
390.33000	305.80000	75.24526	14.06148	3.27011	6.11511	0.00000	1.31000	0.00000	0.00000
390.34000	111.00000	69.36937	21.62162	3.60360	5.40541	0.00000	0.00000	0.00000	0.00000
390.35000	107.00000	73.83178	14.95327	.93458	9.34579	0.00000	.93500	0.00000	0.00000
390.36000	99.00000	67.67677	20.20202	1.01010	9.09091	0.00000	3.03000	0.00000	0.00000
390.37000	54.00000	66.66667	12.96296	11.11111	3.70370	0.00000	3.70000	0.00000	0.00000
288.11000	188.00000	60.63830	30.31915	1.59574	6.91489	0.00000	.53200	0.00000	0.00000
288.21000	75.00000	62.66667	13.33333	12.00000	8.00000	0.00000	2.67000	1.33333	0.00000
288.22000	77.00000	70.12987	18.18182	5.19481	5.19481	0.00000	1.30000	0.00000	0.00000
288.23000	23.00000	86.95652	8.69565	4.34783	0.00000	0.00000	0.00000	0.00000	0.00000
288.31000	524.00000	75.95420	14.88550	2.48092	6.29771	0.00000	.38200	0.00000	0.00000
288.32000	111.00000	75.67568	11.71171	5.40541	4.50450	.90090	1.80000	0.00000	0.00000
288.33000	532.00000	68.60902	20.11278	5.82707	4.51128	0.00000	.37600	0.00000	0.00000
288.34000	23.00000	65.21739	30.43478	0.00000	4.34783	0.00000	0.00000	0.00000	0.00000
288.41000	119.00000	67.22689	19.32773	3.36134	8.40336	.84034	0.00000	.84034	0.00000
288.42000	228.00000	65.78947	20.61404	3.94737	7.89474	.43860	.43900	0.00000	0.00000
288.43000	32.00000	75.00000	9.37500	3.12500	9.37500	0.00000	0.00000	0.00000	0.00000
288.44000	37.00000	67.56757	18.91892	10.81081	2.70270	0.00000	0.00000	0.00000	0.00000
288.45000	155.00000	77.41935	10.32258	3.22581	9.03226	0.00000	0.00000	0.00000	0.00000
289.51000	245.00000	71.42857	19.59184	2.44898	6.12245	0.00000	.40800	0.00000	0.00000
288.52000	1062.00000	76.27119	16.19586	1.03578	4.33145	.94162	.37700	.09416	0.00000
288.53000	131.00000	80.91603	11.45038	1.52672	5.34351	0.00000	0.00000	.76336	0.00000
288.54000	72.00000	83.33333	2.77778	11.11111	2.77778	0.00000	0.00000	0.00000	0.00000
288.55000	156.00000	73.07692	17.94872	3.84615	5.12821	0.00000	0.00000	0.00000	0.00000
288.56000	49.00000	73.46939	18.36735	2.04082	6.12245	0.00000	0.00000	0.00000	0.00000

TABLE 9.13: Continued, page 4

Concentr	N Lithics	%TrimFlks	%RegulFlks	%Shat&Blks	%DecorFlks	%ThinFlks	%Bifaces	%Cores	%Unif&RetF
281.41000	1222.00000	58.83797	12.60229	20.62193	6.54664	.08183	.40900	0.00000	0.00000
281.42000	296.00000	56.75676	14.52703	21.62162	11.14865	0.00000	1.01000	0.00000	.33784
281.43000	708.00000	57.62712	13.70056	18.22034	8.33333	.14124	.42400	0.00000	0.00000
281.44000	363.00000	48.48485	11.01928	30.85395	7.43802	0.00000	.82600	0.00000	0.00000
281.45000	564.00000	48.22695	20.03546	23.04965	7.62411	.17730	.53200	0.00000	0.00000
281.46000	1214.00000	51.40033	14.57990	26.02965	7.08402	.08237	.24700	0.00000	0.00000
281.47000	662.00000	54.38066	12.23565	21.60121	10.57402	0.00000	.30200	0.00000	.15106
281.48000	313.00000	40.57508	15.65495	32.58786	9.90415	0.00000	.95800	0.00000	0.00000
169.11000	20.00000	10.00000	75.00000	5.00000	0.00000	5.00000	5.00000	0.00000	0.00000
169.21000	32.00000	34.37500	43.75000	15.62500	3.12500	3.12500	0.00000	0.00000	0.00000
169.22000	31.00000	22.58065	58.06452	12.90323	0.00000	0.00000	6.45000	0.00000	0.00000
282.11000	37.00000	64.86486	18.91892	8.10811	8.10811	0.00000	0.00000	0.00000	0.00000
282.12000	146.00000	71.91781	7.53425	12.32877	6.16438	0.00000	2.05000	0.00000	0.00000
282.21000	36.00000	75.00000	11.11111	11.11111	0.00000	0.00000	2.78000	0.00000	0.00000
282.22000	221.00000	71.94570	19.45701	4.07240	1.35747	1.80995	.45200	0.00000	0.00000
282.23000	850.00000	75.29412	13.88235	5.52941	4.58824	0.00000	.35300	0.00000	0.00000
282.24000	1730.00000	75.95376	13.23699	5.72254	4.27746	.11561	.23100	0.00000	0.00000
282.31000	15.00000	60.00000	26.66667	6.66667	6.66667	0.00000	0.00000	0.00000	0.00000
282.41000	332.00000	73.79518	8.43373	10.84337	4.81928	.60241	.60200	0.00000	0.00000
282.42000	147.00000	62.58503	14.28571	14.96595	8.16327	0.00000	0.00000	0.00000	0.00000
355.11000	35.00000	57.14286	8.57143	17.14286	7.14286	0.00000	0.00000	0.00000	0.00000
355.12000	269.00000	75.46468	10.78067	8.17844	4.08922	0.00000	.37200	0.00000	0.00000
355.21000	28.00000	85.71429	3.57143	0.00000	0.71429	0.00000	0.00000	0.00000	0.00000
356.11000	21.00000	71.42857	14.28571	4.76190	4.76190	0.00000	0.00000	0.00000	0.00000
356.12000	37.00000	51.35135	13.51351	32.43243	2.70270	0.00000	0.00000	0.00000	0.00000
356.21000	1465.00000	66.89420	7.71331	17.61092	6.48464	0.00000	.13700	0.00000	0.00000

TABLE 9.14: Scores for Assemblages with > 100 Artifacts

(N = 98; - = low score, + = high score, M = moderate score, A = absent)

Conc.	N Lithics	Trim Flakes	Regular Flakes	Shatter & Blocks	Decort. Flakes Thinning Flakes	Bifaces	Cores	Unif. & Ret. Flakes	Inferred Predominant Activities: Manufacturing primary	Manufacturing late	Lithic Tool Maintenance
308.11	2067	+	-	-	-	M	M	+	+	*	*	*
.12	229	+	M	-	M	A	A	A	A		*	*
.14	1954	+	M	M	-	A	M	A	+		*	*
.21	167	M	M	-	+	A	+	A	A	*	*	
.22	115	+	-	M	-	A	M	A	A		*	*
.24	119	M	+	M	M	A	M	A	A	*		
.33	209	+	M	-	M	+	M	+	+	*	*	*
.34	636	M	M	M	M	A	M	+	A	*		
.41	260	M	-	M	+	A	+	A	A	*	*	
.42	691	M	M	M	M	+	M	A	A		*	
.43	267	M	M	M	-	A	M	+	A	*		
.51	1125	+	-	M	M	+	M	+	A	*	*	*
.71	218	M	+	M	M	+	M	+	A	*	*	
323.21	488	+	M	-	M	A	M	+	A	*	*	*
.22	2569	+	-	-	-	M	M	A	A		*	*
.23	231	M	M	-	M	+	M	A	A		*	
273.31	237	M	M	M	M	+	M	A	A		*	
274.12	2139	M	M	M	M	M	M	+	+	*	*	*
.13	133	M	+	M	M	A	+	A	A	*	*	*
.22	212	M	+	M	M	+	+	A	A	*	*	*
341.21	2717	+	-	M	-	+	M	+	A	*	*	
.22	311	M	M	M	M	A	M	A	A		no high scores	
.23	3107	+	M	-	-	+	M	A	+		*	*
.24	4157	+	-	-	-	+	M	+	A	*	*	*
288.11	188	M	+	-	M	A	M	A	A			
.31	524	+	M	-	M	A	M	A	A		*	*
.32	111	+	-	M	-	+	+	A	A		*	*
.33	532	M	M	M	-	A	M	A	A		no high scores	
.41	119	M	M	M	M	+	A	M	A		*	
.42	288	M	M	M	M	+	M	A	A		*	
.45	155	+	-	M	M	A	A	A	A		*	*
.51	245	M	M	-	M	A	M	A	A		no high scores	
.52	1062	+	M	-	-	+	M	+	A	*	*	*
.53	131	+	M	-	-	A	A	+	A	*	*	*
.55	156	+	M	M	-	A	A	A	A		*	*
.63	116	M	M	M	M	A	+	A	A		*	
390.31	102	+	M	-	M	A	A	A	A		*	*
.33	305	+	M	M	M	A	+	A	A		*	*
.34	111	M	M	M	-	A	A	A	A		*	
.35	107	+	M	-	M	A	M	A	A		*	*
333.11	446	+	-	-	-	A	M	A	A		*	*
336.11	274	+	-	-	-	A	M	A	A		*	*
336.12	241	+	M	-	-	+	A	A	A		*	*
336.14	719	+	-	-	-	A	M	A	A		*	*
337.11	238	+	-	-	-	A	M	A	A		*	*
374.11	517	-	+	M	M	_	M	A	A	*	*	*
.21	1415	M	M	M	+	+	M	A	+	*	*	*
.43	350	M	+	M	M	+	+	A	A	*	*	
.45	302	M	+	M	M	+	A	A	A	*	*	
.46	466	M	+	M	M	+	M	A	A	*	*	
.51	201	M	M	M	M	+	M	A	A		*	
.54	612	M	+	M	+	+	M	A	A	*	*	
355.12	269	+	-	M	-	A	M	A	A		*	*
356.21	1465	M	-	+	M	A	M	A	A	*		
282.12	146	M	-	+	M	A	+	A	A	*	*	*
.22	221	M	M	M	-	+	M	A	A		*	
.23	850	+	-	M	-	A	M	A	A		*	*
.24	1730	+	-	M	-	M	M	A	A		*	*
.41	332	+	-	M	-	+	M	A	A		*	*
.42	147	M	M	+	M	A	A	A	A	*		
281.12	508	M	M	+	M	A	A	A	A		*	*
.13	539	-	M	+	M	+	M	A	A		*	*
.14	314	-	M	+	M	+	M	A	A		*	*
.15	164	-	M	+	M	A	+	A	A		*	*
.22	137	M	-	+	+	A	+	A	A	*	*	*
.23	107	-	-	+	M	+	M	A	A	*		*
.25	106	-	M	+	+	A	+	A	A	*	*	*
.31	149	M	M	+	M	A	+	A	A		*	*
.33	494	M	-	+	M	A	M	A	A		*	*
.34	177	M	M	+	M	A	M	A	A		*	*
.41	1222	M	-	+	M	M	M	A	A		*	*
.42	296	M	M	+	+	A	+	A	+	*	*	*
.43	708	M	-	+	M	M	M	A	A		*	*
.44	363	-	-	+	M	A	M	A	A		*	*
.45	564	-	M	+	M	M	M	A	A		*	*
.46	1214	M	M	+	M	M	M	A	A		*	*
.47	662	M	-	+	M	A	M	A	+		*	*
.48	313	-	M	+	M	A	M	A	A		*	*

TABLE 9.15: Expected Pattern of High Relative Frequencies of Remains for Different Activity Sets

Activity:	Primary Lithic Manufacturing	Secondary Manufacturing	Lithic Tool Maintenance
Trim Flakes		+	+
Regular Flakes	+		
Shatter and Blocks	+		
Decortication Flakes	+		
Thinning Flakes		+	
Bifaces		+	+
Cores	+		
Unifaces and Retouched Flakes			+

A substantial amount of primary lithic manufacturing was suggested by the consistent high scores for shatter and blocks at 19BN281. In only three cases, however, were these scores accompanied by high scores for decortication flakes, and none of those assemblages contained cores. So, the primary lithic manufacturing inference was based mainly upon the shatter and block scores. The 19BN281 assemblages are composed overwhelmingly of quartz artifacts. Even late stage manufacture and maintenance of quartz tools or flakes, creates large amounts of shatter and blocks. At the Sassafras quartz quarry site in Rhode Island, for example, between 44% and 50% of the assemblage was composed of remains similar to those classified here as shatter and blocks (Barber 1981:56). Yet in the 19BN281 assemblages the shatter and block scores ranged from only 16% to 32%. These scores were high within the survey data set, but far short of what might be expected from primary reduction and shaping activity as suggested by the Sassafras site assemblage. For these reasons, except for the three assemblages with high decortication flake scores, the shatter and block scores for the 19BN281 assemblages were interpreted as the results of late stage manufacturing and tool maintenance rather than primary manufacturing.

Summary

This chapter has identified the characteristics of archeological deposits within concentrations with at least some dense remains. It has described and analyzed the lithic assemblages associated with these concentrations technologically. Inferences were made about some of the prehistoric activities represented by these assemblages.

Chapter 16 combines information on the deposit types and the lithic activity analysis with data from the following chapters on prehistoric pottery and lithic raw materials, faunal and floral remains and shellfish remains to identify a bit more specifically the activities associated with each concentration. Chapter 16, in addition , synthesizes the prehistoric data available from this stage of analysis and compares the patterns observed with the interpretations of prehistory reviewed in Chapter 5.

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CHAPTER 10

Floral and Faunal Archeological Remains

Joyce Fitzgerald

Introduction

The purpose of this chapter is twofold. First, it will organize, describe and evaluate all the floral and faunal data collected during excavation and flotation from the 1979 through the 1981 field seasons. Second, it will generate hypotheses concerning patterned behavior as it is represented in the floral and faunal archeological data. Data on shellfish remains are dealt with separately in Chapters 11 and 12.

The floral and faunal data presented in this chapter represent the first phase of subsistence analysis and contribute to the analysis of seasonality. Remains were classified into general data categories by the diagnostic criteria discussed in the next section of this chapter. During the analysis, categories were recorded by weight and by frequency. Weight was selected as the descriptive unit of measure for this report due to the fragmentary condition of the material. While these general categories are useful management and descriptive tools, data from the next phase of the analysis, species identification, will provide the additional data needed to answer specific questions concerning diet and seasonalilty.

For the most part, the project area is plow-disturbed and artifacts occurred primarily in the plowzone strata. Since plowing can fracture delicate bones and floral remains, preservation and recovery may have been skewed toward the larger, more resistant remains, such as mammal bone. Comparatively, subplowzone strata exhibited more variation, and therefore, they may be more accurate representations of the species that were exploited.

Field Collection Methods

The survey employed a systematic sampling technique to test sample units and for initial site examination. A grid system of shovel tests was used (see Chapter 2). Shovel tests, with a standard diameter of about 40 cm, were excavated and sieved through 1/4 inch mesh screen. The materials recovered were bagged and catalogued as one stratigraphic unit. Excavators, however, often noted materials that were found below the plowzone stratum.

Further, intensive site examination involved more careful excavation and more precise stratigraphic control. Excavation units were troweled or shovel-scraped and the soil sieved through 1/4 inch mesh screen. Recovered artifacts were bagged and catalogued by provenience level.

Since food refuse, particularly seeds, nuts and bones, generally occurs in discrete clusters, such as in refuse pits, hearths and dumps, its discovery and recovery undoubtedly has been reduced because of plowing disturbances and limited by the 1/4 inch mesh screen used for recovery during hand excavation.

Flotation Methods

Water flotation, as popularized by Stuart Struever, has made the recovery of small-scale archeological remains possible. Most flotation techniques have followed the basic principle "... that different substances (such as stone, burned clay, bone and charred plant remains) have different porosities and therefore settle in water at different rates" (Struever 1968:354). In general, flotation samples are collected from areas likely to yield organic archeological remains that are too small to be recovered by a standard 1/4 inch-mesh field screen. When the samples are submerged in agitated water, soil is dispersed and the heavy and light fractions easily separate. Each fraction is collected, air dried and examined for archeological remains.

The need for efficiency tests of individual flotation systems recently was noted by Wagner (1982:127) whose test results indicate that different systems, methods, equipment and personnel yield a wide range of recovery rates. To approximately measure the effectiveness of flotation systems and recovery rates for soil samples, a poppy seed control procedure has been adapted (Kaplan 1975; Fitzgerald 1982a and b; and Wagner 1982).

Poppy seeds are naturally buoyant; however, they tend to slowly sink as soon as water tension is broken. The same is true for most archeological seeds, particularly water-saturated carbonized seeds. Thus, the recovery rate of a known number of

poppy seeds introduced into a measured soil sample prior to flotation can illustrate differences in recovery rates for individual soil samples due to variable soil types and/or human inconsistencies in the flotation process. These differences in recovery rates then can be considered in the final interpretation of small scale archeological remains. The poppy seed test also may point out needed improvements in the flotation design or methods to increase the overall recovery rate of the system.

The Original Cape Cod Survey Flotation System (1979-1981)

During the fieldwork subplowzone features, defined as soil anomalies or dense artifact concentrations, were collected in cloth bags and returned to the lab for water flotation. With few exceptions, all floral remains were retrieved by flotation, whereas faunal remains were recovered by both hand excavation and flotation efforts.

Due to the flotation process and the density of artifacts in features, flotation data are more varied and more dense than hand excavated data. Consequently, the amount of soil floated must be factored into descriptions of the remains, particularly for the artifact classes sensitive to flotation collection methods, such as floral and faunal remains.

The tub-type flotation system (Struever 1968) was used through the 1981 field season (Borstel 1981) and consisted of:

- 10 quart galvanized pail, bottom removed and lined with fly screen mesh (17 openings to the inch)
- 30-40 gallon plastic garbage can
- tea strainer (20 openings to the inch)

Soil samples, while still in the cloth field bags, were weighed to the nearest gram, then poured into graduated beakers to record loose soil volume to the nearest 500 ml. In small amounts, the sample was poured into the submerged 10 quart pail, the pail was agitated to set the light fraction into suspension, where it was skimmed off with the tea strainer. The heavier fraction sank to the bottom of the 10 quart pail. Both the heavy and light fractions were air dried and stored separately in plastic bags. To test the effectiveness of this method, one hundred poppy seeds were added to each flotation sample processed during the months of October and November 1981. The poppy seed recovery rate for these samples rarely exceeded 1%.

The 1982 Revised Flotation System

In an attempt to improve the recovery rate of the original system a number of minor changes were made (Fitzgerald 1982a).

In addition to the small tea strainer used to skim the light fraction, a larger, five inch diameter vegetable strainer was

used during the skimming process to reach the materials floating below the water surface. Both strainers were lined in a chiffon material with microscopic openings, about 40 openings/inch, to retrieve minute seeds such as Nicotiana rustica.

The galvanized bucket used originally to retain the heavy fraction and agitate the water, was replaced by a twelve-quart cooking pot with handles. The base of the pot was cut away, and two layers of fly screening, 17 openings/inch inserted. One person aerated the water by holding a trigger type garden hose sprayer attachment directly under the base of the pot. Simultaneously another person skimmed off the light fraction floating on or near the water surface. Suspending the pot by side handles allowed the person skimming more space to reach into the pot and skim off the light fraction before it became waterlogged and thus too heavy to float.

During the recording and weighing stage, 100 noncarbonized poppy seeds were randomly distributed throughout each 2000 ml of soil. The poppy seeds served once again, as a control to determine a relative recovery rate for each flotation sample.

Recovery rates for the revised tub flotation method were slightly higher than the recovery rates for the 1980-81 tub method (Table 10.1). By comparison, the recovery rate of poppy seeds from a tub-type flotation system is still well below the range obtained by others using a froth/aeration flotation design (Table 10.2).

In light of this analysis, soil samples from the 1982 field season (not included in this report) were processed by Paige Newby using the aeration flotation system, with a known recovery rate of 30%, at Brown University (Fitzgerald 1982b).

Flotation Scanning Process

In the scanning process archeological remains are separated from other materials in both the heavy and light fractions. This process is tedious and it demands an enormous time investment.

The following equipment was used in scanning the heavy and light fractions recovered from floated soil samples:

- 10 X illuminated magnifying lamp
- American Optical 7-30X binocular microscope
- 1/4 inch, 1/8 inch sieves
- feather weight forceps
- fine paint brush

Heavy and light flotation fractions were sorted and catalogued separately. Each fraction was passed through a set of sieves. The size categories, 1/4 inch, 1/8 inch, and <1/8 inch, were maintained for easier sorting and recording. Depending upon their size, archeological remains were sorted by visual

TABLE 10.1

EVALUATION OF THE REVISED FLOTATION SYSTEM[a]

Provenience	Number Of Poppy Seeds Added	Number Of Poppy Seeds Recovered
Feature 8, west half	500	15
Feature 8, east half	100	1
Feature 9, level 073	284	1
EU Level 073, bucket 13	100	6
EU Level 052	200	8
EU Level 030	100	5
	1283	36

Poppy Seed Recovery Rate = 2.8%

NOTES

[a] All proveniences are from 19BN308, Excavation Unit 300, Concentration .33.

TABLE 10.2

Recovery Rates for Aeration/Froth Flotation Techniques

1.	30% (average for 88 samples)	Archaeology Lab, Anthropology Department, Brown University (Fitzgerald 1982)
2.	80% (highest recovery rate) 27% + 47% (2 feature samples)	Biology Laboratory, Biology Department, University of Massachusetts, Boston Lawrence Kaplon and Toyna Largy (Personal Communication 1982)

examination; most often, however, the smallest size category (< 1/8 inch) required magnifying lenses or a microscope. Although all archeological artifact classes were sorted and recorded during the scanning process, for the purpose of this chapter floral and faunal data are restricted to seeds, nuts and bone.

With few exceptions all floral materials were retrieved by water flotation. Although the recovery rate proved to be low, a number of species were recovered. Both the heavy and the light fractions in the 3 size categories-- 1/4 inch, 1/8 inch, and <1/8 inch-- were scanned for floral materials. Carbonized and noncarbonized seeds and nuts were separated and placed in vials for the next stage of analysis.

To distinguish seeds from nuts, the scanners used diagnostic criteria: presence of seed coat, hilum wall thickness, sculpturing, color, fracture type and surface texture. These, however, can be particularly difficult to discern in tiny, fragmented, carbonized seeds and nuts. Nutlets, such as Alnus and Betula (Schopmeyer 1974), were classified as seeds in this study since they are not of the same economic importance as the major nut producing trees, such as Quercus and Carya.

Faunal remains, including fish scales and otoliths, were separated from the 1/4 inch and 1/8 inch size categories of both the heavy and the light fractions. The presence of faunal remains in the <1/8 inch size category was noted. Faunal materials were sorted by eye or with the aid of 10X magnifying lamp.

Preliminary Analysis of Floral and Faunal Materials

The second sorting stage divided the floral and faunal remains, from both flotation and hand excavation, into working categories (Tables 10.3 and 10.4), in preparation for the final analysis stage-- species identification.

Floral Remains

For the most part, these remains were recovered by flotation. Four major working categories were used to classify seeds and nuts: diagnostic, nondiagnostic, carbonized and noncarbonized (Table 10.3). Within these categories seeds and nuts were counted and weighed. Seeds were considered complete when 3/4 or more of the seed was present. During the survey no complete nuts were recovered, and at this stage of the preliminary analysis no attempt has been made to reconstruct the number of nuts consumed. Diagnostic nut hulls and seed fragments were counted and weighed while the nondiagnostic remains were only weighed. Weight for each category was recorded to the

TABLE 10.3

CACO Floral Catalog Worksheet

Provenience:_____ Concentration:_____ Name:_____
Date:_____

Light Fraction_____
Heavy Fraction_____
Hand Excavation_____

Mesh size 1/4"___ 1/8"___ <1/8"___

	Carbonized		Noncarbonized		Total	
	Weight	Frequency	Weight	Frequency	Weight	Frequency
Complete Diagnostic Seed						
Diagnostic Seed Fragment						
Nondiagnostic Seed Fragment						
Diagnostic Nut						
Nondiagnostic Nut						
Unidentified						
Total						

Comments:

TABLE 10.4

CACO Faunal Catalog Worksheet

Provenience:_____ Concentration:_____ Name:_____
Date:_____

Light Fraction_____
Heavy Fraction_____
Hand Excavated_____

Mesh Size 1/4"_____, 1/8"_____

	Diagnostic		Nondiagnostic		Total	
	Weight	Frequency	Weight	Frequency	Weight	Frequency
Bird						
Fish						
Mammal						
Other						
Unidentified						
Total						

Comments:

nearest .01 gram. Since most floral materials were fragmented, weight was used as the unit of measure for this report. The frequency for each species will become more important in the next stage of analysis. Botanical and descriptive elements such as color, sculpturing, hilum, ridges, margins, embryo or endosperm channels, distinctive shape, and wings (Montgomery 1977; Martin and Barkley 1961), were used to classify seeds and nuts as diagnostic.

Faunal Remains

Faunal remains were recovered by both flotation and hand excavation methods. Hand excavated faunal remains usually fall into the 1/4 inch and larger size range; these bones were counted and weighed to the nearest .1 gram. Flotation faunal remains included the smaller 1/8 inch size fraction; these were weighed to the nearest .01 gram.

Bone was bagged separately in the field and processed carefully in the lab. Depending upon the state of preservation, bone was left 'as is', rinsed, or gently brushed. Faunal material was not treated chemically in the field or in the lab. One exception was a large, poorly preserved specimen from Concentration 323.22 that had to be treated in the ground to avoid additional disintegration and damage.

Faunal materials were sorted into bird, fish and mammal class categories by physical properties such as: texture, size, density, structure and anatomical part. The "other" category generally included turtle carapace or bone and sea mammal bone (Table 10.4). Within the class categories the following anatomical parts were used to identify diagnostic bones: distal or proximal ends, ribs, mandibles, teeth, otoliths, scales, skull bones, antlers and epiphyses.

Discussion

For the most part we have assumed that noncarbonized seeds reflect modern contaminants. There is good evidence to support this assumption. It has been recognized by several researchers that very few noncarbonized seeds can exist longer than one century with most perishing in a much shorter period of time (Minnes 1980; Quick 1961; Harrington 1972; Justice and Bass 1978). Most noncarbonized plant tissues decay rapidly in humid environments and acidic soils (Asch and Asch 1977). These conditions characterize the project area where pH values mostly range between 3.6-6.0. We have assumed, therefore, that noncarbonized seeds represent modern contaminants, and that only carbonized seeds could have survived from prehistoric time periods.

The majority of floral remains were recovered from feature flotation samples in 1980 and 1981. In the field features were defined as visible anomalies exhibiting one or more of the following characteristics: discrete shape, evidence of *in situ* burning and/or dense concentration of shell, bone, charcoal, fire-cracked rock, or a combination of these. If, by archeological criteria, a feature was established firmly as cultural, soil samples were collected for flotation. Consequently, the volume of soil floated per concentration reflects the density of features encountered in the field. Some anomalies designated as features in the field were later determined to be postdepositional disturbances, generally attributed to rodent burrowing, most of which are not considered in this report.

Although most floral remains were recovered from feature flotation, some carbonized nut shell fragments from nonfeature areas were large enough to be caught in the 1/4 inch mesh screen typically used during excavation. These were also assumed to be of prehistoric origin. Two nonfeature carbonized corn kernels were recovered at 19BN288 in the same way during hand excavation. These were identified as eight-rowed Northern Flint Indian corn (Galinat, personal communication). Hand excavated faunal remains were also considered to be prehistoric in origin, except when they were associated exclusively with historic deposits, or when they could be identified as domestic species.

For this preliminary analysis, I have assumed carbonized remains from features to be the result of prehistoric cultural deposits. However, another line of evidence, namely the selection, flotation, and analysis of off-site control soil samples, remains to be done. The control floats will provide an index of non-cultural fires, possibly attributed to natural occurrences (Patterson 1984), and the natural seed rain (Kaplan 1977) for a given environment. Carbonized material in a control float might indicate that carbonized materials result from modern or historic forest fires, i.e. they are noncultural, while the absence of carbonized botanical materials would reinforce the idea that the carbonized seeds and nuts probably are contemporary with the archeological deposits. In much the same way, where the preservation potential is high due to the shell density, the cultural origin of noncarbonized seeds from an archeological context will be evaluated by comparison to the natural seed rain, noting occurrences of particular species and/or the condition of the seed coat and the state of preservation. Consequently, the cultural association of some botanical remains may require reconsideration when the control tests are completed.

Differential Preservation and Recovery

In general, small floral and faunal remains are infrequent in the archeological deposits that have been examined. The recovery and preservation of these data classes depend upon circumstances of deposition, preservation, volume of soil floated and the flotation recovery rates (Asch and Asch 1977; Fitzgerald 1981; Struever 1968). All of these considerations must be taken into account in interpreting the variation in floral and faunal remains among the deposits described and analyzed in this report.

Weights for floral and faunal remains are discussed in this report as relatively high, low and rare. These observations are based upon relative soil volumes from excavation and flotation. They are useful descriptive terms when comparing the relative abundance of classes of floral and faunal remains in sites, concentrations or features.

Of particular concern to this preliminary analysis is the comparability between concentrations with substantial shell remains, where the preservation potential is expected to be high due to the buffering effect of shell; and those concentrations with little shell remains, where the preservation potential is low due to the more acidic soils. Another potential bias is the absence of flotation data for many concentrations and the relatively small volume of soil floated overall. Soil samples for flotation floral and faunal analysis were taken only from archeological features; therefore, small floral and faunal archeological remains, if present in the general soil matrix, were not recovered. Finally, flotation samples processed in successive years have progressively improved recovery rates. Different rates will be considered in making substantive comparisons where recovery rate data have been collected.

Descriptions of the Floral and Faunal Remains

This section focuses on a sample of sites from three of the major geographic areas around Nauset Bay (see Foldout Map B). Two important sites, with abundant faunal and floral remains, including Northern Flint corn, are not included here. One is at Fort Hill, 19BN323; and one is on the north side of Salt Pond, 19BN390. The remaining sites around Nauset Bay exhibited low floral/faunal recoveries. Some High Head areas of Truro (see Foldout Maps K and L) with high floral/faunal recoveries deserve mention. These are 19BN410 and 19BN481. On the Herring River, Wellfleet (see Foldout Map I), at 19BN471, bone is also fairly well represented, but not abundant.

These and some smaller sites with low faunal/floral recoveries are still being analyzed and will be described in a future report.

In this section, floral/faunal remains will be described and analyzed. Site data will be presented from south to north beginning with the southernmost site in the study area of Fort Hill, 19BN308. The implications that these remains hold for prehistoric subsistence and seasonality will be posited, but remain tentative due to the preliminary nature of the analysis.

19BN308

Site 19BN308 comprises a large area of Fort Hill, approximately 67,300 square meters, overlooking Nauset Marsh. In addition to plow disturbances, major earth moving projects for roads and a parking lot have been undertaken in parts of this area (Foldout Map D). Despite these disturbances, floral and faunal remains were abundant in three subplowzone middens in Concentrations 308.33, .42, and .71.

Concentration 308.33

Concentration .33 is on the eastern side of the site at the base of Fort Hill, just a few meters north of Nauset Marsh and a fresh water spring (Foldout Map D). An intact subplowzone midden, approximately 55 cm thick, was identified in 10 shovel tests and one 1.5 x 1.5m excavation unit. Radiocarbon dates from shell in Excavation Unit 300, of 910 $\pm$ 145 BP from the top of the midden and 3350 $\pm$ 170 B.P. from the base of the midden, demonstrate a long history for this stratified deposit (see Chapter 8). Since the stratigraphic components are still being studied, the midden will be considered as one unit for this report. The shell midden may encompass a total area of 700 square meters. It appeared to extend beyond Concentration 33 into Concentration 32, where a midden layer was identified in one shovel test, and into other nearby areas, where it was visibly eroding out of road-cuts.

Faunal remains were most abundant within the midden. A total of 718.1 grams were recovered in this concentration (see Table 10.5). Almost all of these (90.8%) came from Excavation Unit 300, where the highest volume of soil, 2,319,220 cubic cm, was excavated. Two features (Table 10.6) near the base of the midden in Excavation Unit 300 were collected for flotation. These contained 56.3 grams of bone and another 19.1 grams were recovered in hand excavation. Virtually all floral remains, .4 grams, were recovered in these feature flotation samples.

Concentration 33 follows the typical relative frequency pattern, based on weight, for faunal remains at 19BN308. Mammal remains are most abundant, comprising 79.8% of the total faunal

TABLE 10.5a: Floral and Faunal Remains, 19BN308

Hand Excavated

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
308.11	1,107,723	0	1.9	20.5	2.5	1.4	*26.3	0	0	0
.12	432,239	0	*	0.4	0	0	*0.4	0	0	0
.14	1,062,599	0.1	0.3	7.8	5.1	*1.2	*14.5	0	0	0
.15	384,586	0	0.4	0	0	0	0.4	0	0	0
.21	871,049	0.1	2.2	24.2	2.6	*3.4	*32.5	0	0	0
.22	472,021	0	0	2.6	0	0	2.6	0	0	0
.32	268,032	*	0.6	1.5	*	1.7	3.8	0	0	0
.33	2,790,173	*33.7	*66.0	*389.3	61.8	111.0	661.8	0	0	0
.34	735,977	0	0	2.4	0	0	2.4	0	0	0
.41	2,325,328	.0.7	0	1.2	0.2	0	2.1	0	0	0
.42	3,993,980	*16.4	*5.0	296.9	147.0	*46.8	*512.1	0	0.07	P
.43	1,130,000	0.3	0	12.3	0	*1.2	*13.8	0	0	0
.51	1,143,144	0	0	34.5	4.4	*2.0	40.9	0	0	0
.52	803,840	0	0	3.8	0	0	3.8	0	0	0
.71	327,623	*9.3	*15.8	87.2	135.4	8.8	256.5	0	0	0
.00	7,543,105	0	0	7.8	0	2.1	9.9	0	0	0
Totals	26,499,142	*60.6	*92.2	*892.4	*359.0	*179.6	*1583.8	0	0.07	P

TABLE 10.5b: Floral and Faunal Remains, 19BN308

Flotation

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
308.11										
.12										
.14										
.15										
.21	31,900	0	*0.2	0	1.7	2.2	*4.1	*		
.22										
.32										
.33	40,000	0.1	*6.2	30.3	5.4	*14.3	*56.3	*0.40	*	P
.34										
.41										
.42	138,600	*1.1	*0.5	6.4	0.9	*33.6	*42.5	*0.01		P
.43										
.51										
.52										
.71	45,738	0.8	*53.8	2.4	18.6	*6.2	*81.8	0.47	*	P
.00										
Totals	256,238	*2.0	*60.7	39.1	26.6	*56.3	*184.7	*.88	*	P

NOTES:

P = Present

* = Does not include occurrences of less than 0.01 g in total weight

TABLE 10.6

Description of Features Containing Floral Remains, 19BN308.33

Provenience	Stratum	Description	Dimensions	Volume (ml)	Flotation Data: Carb. Seeds (g)	Carb. Nuts (g)	Non-Carb. Seeds (g)	Faunal (g)	Hand Exca. Faunal	Total Faunal
EU 300 Feature 08 Level 061	Subplowzone Black organic Level	Ashy/clay lens with finely crushed, oxidized shell. Possible hearth dumping episode.	34 cm thick in deepest section ca. 95 x 70 cm	20,600	.18	*	P	31.9	7.6	39.5
EU 300 Feature 09 Level 073	Subplowzone Black organics & shell level. Lower level of shell midden	Dense fire cracked rock pavement. Pockets of clayey soil and shell, underlying Fea. 8.	100 x 90 cm. 10 cm thick Feature extends into E.U. wall, total area unknown	10,400	*.22	0	P	24.4	11.5	35.9
TOTALS				31,000	*.40			56.3	19.1	75.4

NOTES:
P = Present
* = Does not include occurrences of less than 0.01 g in total weight

remains are most abundant, comprising 79.8% of the total faunal assemblage. Fish remains rank second with 13.7%, and bird last with 6.4%.

Faunal remains are represented in both features near the base of the midden in Excavation Unit 300. Despite this, they are not more abundant in the features than in other areas of the midden. A platform of fire-cracked rock probably is associated with the Late Archaic radiocarbon date collected 10 cm beneath the feature. Unfortunately, no diagnostic artifacts were recovered to corroborate this. However, similar fire-cracked rock platforms have been identified in the Taunton River basin, in southeastern Massachusetts. These were defined clearly as Late Archaic features by their association with Squibnocket triangle points and radiocarbon dates clustering around 3000 B.P. These have been interpreted as fish drying facilities (Simon 1982). Despite the recovery of only 1.1 g of fish bone in this feature, fish drying may could have occurred here leaving little trace of fish remains, since gutting the fish could have been the only preparation involved. Its presence within the shell midden, however, argues for another function; possibly for drying, smoking, or roasting shellfish.

Floral remains of .4 grams appear to be significant when compared to the flotation volumes and the floral recoveries at other sites. Carbonized seeds were common in both the fire-cracked platform and in the clayey deposit above it. Their presence within these features suggests a food or fuel source, or possibly the remains of scaffolding above the fire-cracked rock. Their presence also suggests the possibility that the activities associated with these features took place during a warm season. Positive identification of the plant species could extend the restricted seasonal indicators of winter - early spring (based on the time of death for shellfish remains, see Chapter 12) through the summer months.

Concentration 308.42

Concentration .42 is located on a flat gentle slope approximately 75 meters north of the salt marsh, close to an inlet from Nauset Bay. Eight 1m x 1m excavation units and 3 shovel tests clearly defined the boundaries of an intact midden near the base of the slope on the south side of Fort Hill. Despite the high volume of soil excavated outside the midden, floral and faunal remains were most abundant within the 30-35 cm thick midden. A radiocarbon date of 3260 $\pm$ 135 B.P. (GX-9700) on shell from within the midden suggests that it may have been contemporary with the midden idenfified in Concentration 33.

A total of 138,600 cubic cm of soil from shell lenses within the midden were sampled for flotation. The heavy fractions contained 42.5 grams of bone; carbonized seeds also were noted in 5 heavy fraction samples, in quantities of <.01 grams. The

presence of carbonized seeds in the heavy fraction suggests that more seeds are probably present in the light fractions; however, only 2 light fractions were scanned for floral remains. One sample, 2400 cubic cm, contained .01 grams of carbonized seeds. This represents an artificially low quantity for the concentration (Tables 10.5 and 10.6) since most light fractions were not sorted. A single carbonized nut fragment was recovered within the midden during hand excavation.

Mammal bone dominated the faunal collection with 93% of the total identified bone. Fish remains were less common in this concentration than bird remains. Fish represented only 1.6% of the total identified bone. In most other concentrations at 19BN308, particularly in the middens in Concentrations 33 and 71, fish bone ranked second to mammal bone, and bird bone was relatively scarce. The reversal in the relative frequency of fish to bird bone in this concentration may indicate seasonal variation within the middens, or perhaps a different activity area near Concentration .42.

The time of death for most shellfish remains within the midden areas suggests that winter was the primary season shellfish was collected and/or deposited at 19BN308 (see Chapter 12). In Excavation Unit 107, however, winter, spring and summer collection periods were indicated. Support for additional seasonal collection periods in this concentration is reinforced by the high density of bird bone in Excavation Unit 107, where 59% of the total identified bird bone for Concentration .42 was collected. An associated decrease in the relative frequency of fish remains for this concentration might support the interpretation of a seasonal shift in the patterns of exploitation at Fort Hill from mammal and fish in the winter, to mammals and birds in the spring and/or fall, when birds are now, and probably were also in prehistoric times, most common in the salt marsh.

Concentration 308.71

Concentration .71 is on the west side of Fort Hill, approximately 60m north of the salt marsh. The concentration is on a relatively flat, gentle slope, within a small valley-like depression. The excavation of four shovel tests, two .5m x .5m and two 1m x 1m excavation units, revealed a subplowzone intact midden below a 19th century deposit of fill.

The 10-15 cm thick midden contained 338.3 grams of bone from hand excavation and flotation, and .47 grams of carbonized seeds from one feature flotation sample. Considering the small volume of soil excavated in this concentration (see Table 10.5), these amounts are significant.

Mammal bone, as usual, ranked highest with 52.9% of the total faunal assemblage. Although this suggests a decrease in

its relative importance when compared to the middens in Concentration .33 and .42, where it represented 79.8% and 93%, respectively, most of its displacement can be attributed to the abundance of fish bone, 41.1%, primarily recovered by flotation from Feature 01 in Excavation Unit 7. In contrast to the other flotation samples from Concentrations .71, .33 and .42, the fish bone in this feature appears to be a discrete deposit. Bird bone, 6%, accounts for the remaining weight.

Feature 01 in Excavation Unit 7 was an irregularly shaped pit just a few meters outside the dense midden deposit. The feature itself contained densely packed shell, as did the larger midden. The exact dimensions of the feature could not be determined since its eastern portion extended into the wall of the excavation unit. The excavated portion averaged 30 x 42 cm and was 36 cm deep; it was almost V-shaped in cross section. Of the excavated portion, only one half was collected for flotation, while the other half was screened in the field. In comparing the results from both halves, the flotation method procuced much higher amounts of fish bone (Table 10.5).

Although the original function of the feature is not known, the presence of both burned and unburned shell, with the absence of in situ burning, suggests that the pit functioned as a depository from nearby food-processing activities. Intensive food-processing also is reflected in the artifacts recovered from the feature, such as: pottery, with thick carbonized residue, charcoal, and plant and animal food remains. It is interesting that a refuse pit would be selected so near a shell midden deposit which is itself a larger refuse deposit. However, burying abundant fish bones rather than leaving them exposed on the midden's surface would discourage insects and scavengers attracted to the area.

Since the fill within the feature was irregular, multiple dumping episodes may have occurred. Although the season of death, based on one shell specimen (see Chapter 12), suggests a winter collection and deposition, the presence of carbonized seeds may indicate an additional warmer season of use and perhaps another dumping episode within the feature. More study on the stratigraphic levels and floral materials within this feature may provide additional seasonal information.

19BN274/339

This site has an area of approximately 3,930 square meters and is located on a low hill overlooking Salt Pond Bay (Foldout Map E). The entire site is plow-disturbed and most artifacts occur in the plowzone stratum. The average shell density for 19BN274/339 is not as high as in some areas around Salt Pond and Salt Pond Bay; its presence, however, has probably contributed to the preservation of faunal remains. Artifacts associated with food collection and preparation, such as pottery and fire-cracked

TABLE 10.7a: Floral and Faunal Remains, 19BN274

Hand Excavated

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
274/339										
.12	5,883,844	3.9	*0.3	86.3	0	12.1	*102.6	0	0	0
.13	808,888	0	0	0	0	0.4	0.4	0	0	0
.31	1,020,514	0	0	0.3	0	0.6	0.9	0	0	0
.00	1,354,964	0	0	0.7	0	0	0.7	0	0	0
Totals	9,068,210	3.9	*0.3	87.3	0	13.1	*104.6	0	0	0

TABLE 10.7b: Floral and Faunal Remains, 19BN274

Flotation

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
274/339										
.12	17,495	0.7	*1.3	0	0	2.2	*4.2	0.05	*	P
.13										
.31										
.00										
Totals	17,495	0.7	*1.3	0	0	2.2	*4.2	0.05	*	P

NOTES:

P = Present

* = Does not include occurrences of less than 0.01 g in total weight

rock as well as floral and faunal remains, are most common in Concentration 274/339.12, in the central northeast section of the site. Here shell density is on the low side of the site average; therefore the relative abundance of faunal remains (Table 10.7) in this concentration is probably more related to very dense organic cultural deposits than to conditions for better preservation.

Concentration 274/339.12

A block of excavation units in this concentration represents the area most intensively tested at 19BN274/339 (Figure 10.1). The cluster placement of adjoining excavation units was designed to examine the dense remains of cultural activity, and to discover subplowzone features in this area.

Primarily, remains were recovered in the plowzone stratum by hand excavation. A subplowzone flotation sample (17,495 ml) was collected from Feature 01 that occurred in adjoining Excavation Units 16 and 23 (Table 10.8). This truncated shell-filled pit was clearly defined at the interface of the plowzone and B horizon. Feature 01 contained a variety of remains, including lithics, bone, fire-cracked rock, burned and unburned shell, charcoal and carbonized seeds and nuts. The presence of charcoal and fire-cracked rock, with an apparent absence of *in situ* burning, suggests that the feature contained a secondary refuse deposit. Artifacts and two radiocarbon samples (Table 10.8) date the feature to the Middle Woodland period (see Chapter 8).

A total of 16,450 ml of soil was collected from a major portion of the feature in Excavation Unit 23. Carbonized seeds (.05 grams) and nut fragments (<.01 grams) were recovered. Additional floral remains occurred in the light fraction flotation sample from the smaller portion of the feature (1045 ml) in Excavation Unit 16, however their exact weight is unknown because they were accidentally contaminated in the laboratory.

Faunal recovery from flotation of the Feature 01 fill was low, only 4.2 grams of bone. However, the 1.3 grams of fish bone recovered represents 81% of the total fish bone recovered from all of 19BN274/339 (Table 10.7).

Mammal bone dominated the total asemblage of hand excavation and flotation bone, with 93.3% of the total 92.5 grams of identified faunal remains. Bird and fish bone accounted for the remaining bone weight in the concentration. This is a common pattern in the majority of concentrations excavated around the Salt Pond and Bay area.

In contrast to Concentration 274/339.12 as a whole, Feature 01 in Excavation Units 16 and 23 displays relatively different proportions of faunal classes. Of the total identified bone, primarily recovered in hand excavation, Feature 01 contained 58%

TABLE 10.8

Description of Features Containing Floral Remains, 19BN274.12

Provenience	Stratum	Description	Dimensions	Volume (ml)	Flotation Data: Carb. Seeds (g)	Carb. Nuts (g)	Non-Carbo. Seeds (g)	Faunal (g)	Hand Exca. Faunal	Total Faunal
EUs 16 and 23 Feature 01[a]	Subplowzone MO-B	Truncated irregular oval pit	49 x 33 cm $\bar{X}$ = 14 cm deep	17,495	.05	*	P			
EU 22[b]	Plowzone ca.20-30 cm below datum	Plow disturbed Hearth ½ of an oval	123 x 93 cm	No Flotation Sample	----------					
TOTALS				17,495	.05					

NOTES

[a] C-14 date for charcoal from EU 23, Fea. 01, Level 027, SE Section, is 1265 ± 130 B.P. (GX 9550); C-14 date for shell from same provenience is 1570 ± 120 B.P. (GX 9551, see Chapter 8.

[b] C-14 date for shell from EU 22, Level 030 is 1285 ± 120 (GX-9552)

P = Present

* = Does not include occurrences of less than 0.01 g in total floral weight

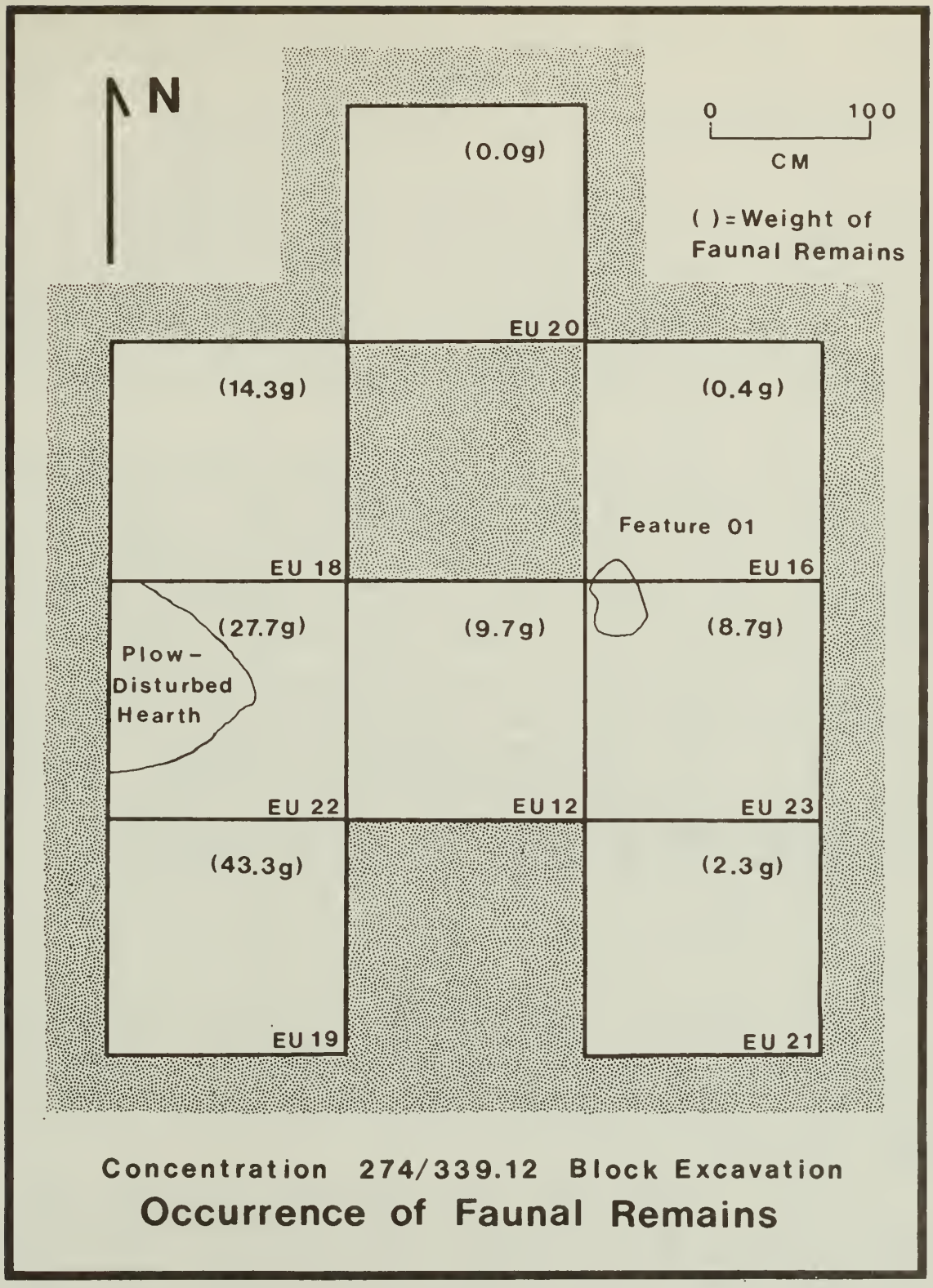
N
0
100
CM
( ) = Weight of Faunal Remains
(0.0g)
EU 20
(14.3g)
(0.4g)
Feature 01
EU 18
EU 16
(27.7g)
(9.7g)
(8.7g)
Plow-Disturbed Hearth
EU 22
EU 12
EU 23
(43.3g)
(2.3g)
EU 19
EU 21
Concentration 274/339.12 Block Excavation
Occurrence of Faunal Remains

FIGURE 10.1

bird bone, or 87% of the total bird bone for the concentration, and only 20.3% mammal bone. Fish bone, recovered only in flotation, accounted for the remaining bone. This anomaly in the relative proportion of faunal classes in Feature 01 may indicate seasonal variation in faunal resources, or perhaps a different food-processing activity or refuse disposal pattern.

What may be a plow-disturbed hearth was excavated (but not sampled for flotation) in Excavation Unit 22, two meters to the west of Feature 01. Like Feature 01, the hearth appears to date to the Middle Woodland period. Both Feature 01 and the hearth contained similar lithic raw material types, particularly yellow or tan jasper. Middle Woodland pottery in and around the hearth and the radiocarbon dates (Table 10.8) from Feature 01 suggest that Feature 01 and the hearth may have been contemporary activities (see Chapters 8 and 14).

In a small 4.5m x 3m area around the hearth, Excavation Units 18, 19 and 22 (Figure 10.1) produced 79.9% of the total faunal remains recovered from Concentration .12. A majority of the pottery, fire-cracked rock and bifacial tools from this concentration were associated with this relatively dense accumulation of mammal bone. Refuse, including fire-cracked rocks and charcoal, in Feature 01 suggests a possible function as a dump for the nearby hearth cleanings and other activities.

Outside Concentration .12 faunal remains were rare. Of the 56 excavation units and shovel tests covering the remaining site area, a total of only 2.4 grams of bone occurred in 5 excavation units. Thus the relative abundance of faunal remains in Concentration .12 appears to be the result of a discrete cultural activity rather than the relatively intensive excavation of the concentration.

19BN341

19BN341 covers approximately 7,625 square meters. A ssubplowzone midden of varying thickness and high shell density was identified in Concentrations 341.21, .23 and .24 (see Foldout E). These formed a 60m arch that contained 95.5% of the total 1,354.9 gram faunal assemblage and all the floral remains from 19BN341 (Table 10.9).

Although these three concentrations received the most intensive testing (8,097,362 cubic cms of excavated soil), the lower faunal recovery from outside these areas does not appear to be proportional to differences in the testing strategy. Only 7.1 grams of bone was recovered, in 9 of the 64 units (2,732,241 cubic cms of excavated soil), outside Concentrations .21, .23 and .24.

Even though the disparity in faunal resources across the site may be partly attributed to poor preservation, differences

TABALE 10.9 a: Floral and Faunal Remains, 19BN341

Hand Excavated

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
341.21	2,227,116	39.0	53.6	512.4	12.9	47.9	665.8	0	0.35	0
.22	559,639	0	0.1	*1.1	0	0.2	*1.4	0	0	0
.23	2,388,087	7.7	4.5	185.1	6.7	15.0	219.0	0	0	0
.24	4,761,709	*10.2	*23.0	163.0	*14.7	*56.7	*267.6	0	2.84	0
.25	195,312	0	0.1	2.2	0	0	2.3	0	0	0
.26	143,864	0	0	2.7	0	0.3	3.0	0	0	0
.00	1,459,472	0.2	0	0	0.2	0	0.4	0	0	0
Totals	11,735,199	*57.1	*81.3	*866.5	*34.5	*120.1	*1159.5	0	3.19	0

TABLE 10.9 b: Floral and Faunal Remains, 19BN341

Flotation

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
341.21	6,066	.2	.6	5.0	0	2.6	8.4	*0.09	*0.44	*0.07
.22										
.23	3,091	0	*.6	4.1	0	3.3	*8.1	*0.02	0	*0.02
.24	22,390	2.4	*132.9	28.5	2.4	*12.7	*178.9	*.70	*.06	*.20
.25										
.26										
.00										
Totals	31,547	2.6	*134.1	37.6	2.4	*18.6	*195.4	*.81	*.50	*.29

NOTES:

P = Present

* = Does not include occurrences of less than 0.01 g in total weight

in disposal patterns were also evident. These differences were particularly clear in the middens of Concentrations .25, .26, and .27, where shell density would have created a favorable environment for bone preservation, but faunal remains were rare. These differences suggest different activity areas, or at the very least, different disposal patterns.

Concentration 341.21

This concentration contained the most faunal remains and one of the highest shell densities of all the concentrations on the south side of Salt Pond. Faunal remains from Concentration .21 comprised 49% of the total faunal assemblage (1354.8g) recovered from 19BN341. Artifact frequencies were also high within the midden. A Late Woodland component, 1000 ± 140 B.P. (GX-9561) and 1375 ± 155 B.P. (GX-9562), was indicated by two radiocarbon dates from shell within the subplowzone section of the midden in Excavation Unit 23.

Faunal remains were recovered primarily in hand excavation within the subplowzone midden in the adjoining 1.5 x 1.5m Excavation Units 17, 22 and 23 (Figure 10.2). A total of 610.8 grams of bone from hand excavation and flotation were identified to class. Mammal bone comprised 87.7% of the total weight. Both bird and fish bone accounted for the remaining weight (Table 10.9). Detailed seasonality studies based on species identification are promising due to the number of diagnostic (long bones, teeth and fish scales) bones recovered. Culturally modified bone is also present in this concentration.

In Excavation Unit 17, soil from a total of 13 subplowzone anomalies, designated as features in the field, was collected for flotation. Faunal recoveries were minimal for all 13 samples; however, 9 of the 13 samples contained carbonized floral remains. Of these, three were probable post hole features; they were approximately 8 cm in diameter, 8-13 cm in depth and somewhat pointed toward the base, with shell and/or bone in their fill. Three others were small shell pockets that filled in natural depressions in the subsoil, and the remainder were natural noncultural disturbances.

Considering the small volume of soil processed in flotation the amount of floral remains (Table 10.9) within these anomalies was fairly significant; .09 grams of carbonized seeds and .44 grams of carbonized nut shell were recovered. The season of death for the majority of shellfish specimens suggests that people were actively depositing shell here from early spring through late summer, and to a lesser extent during fall and winter months (see Chapter 12). Carbonized seeds in the subplowzone strata and carbonized nut fragments from both the plowzone and subplowzone strata, reinforce the summer and fall determination.

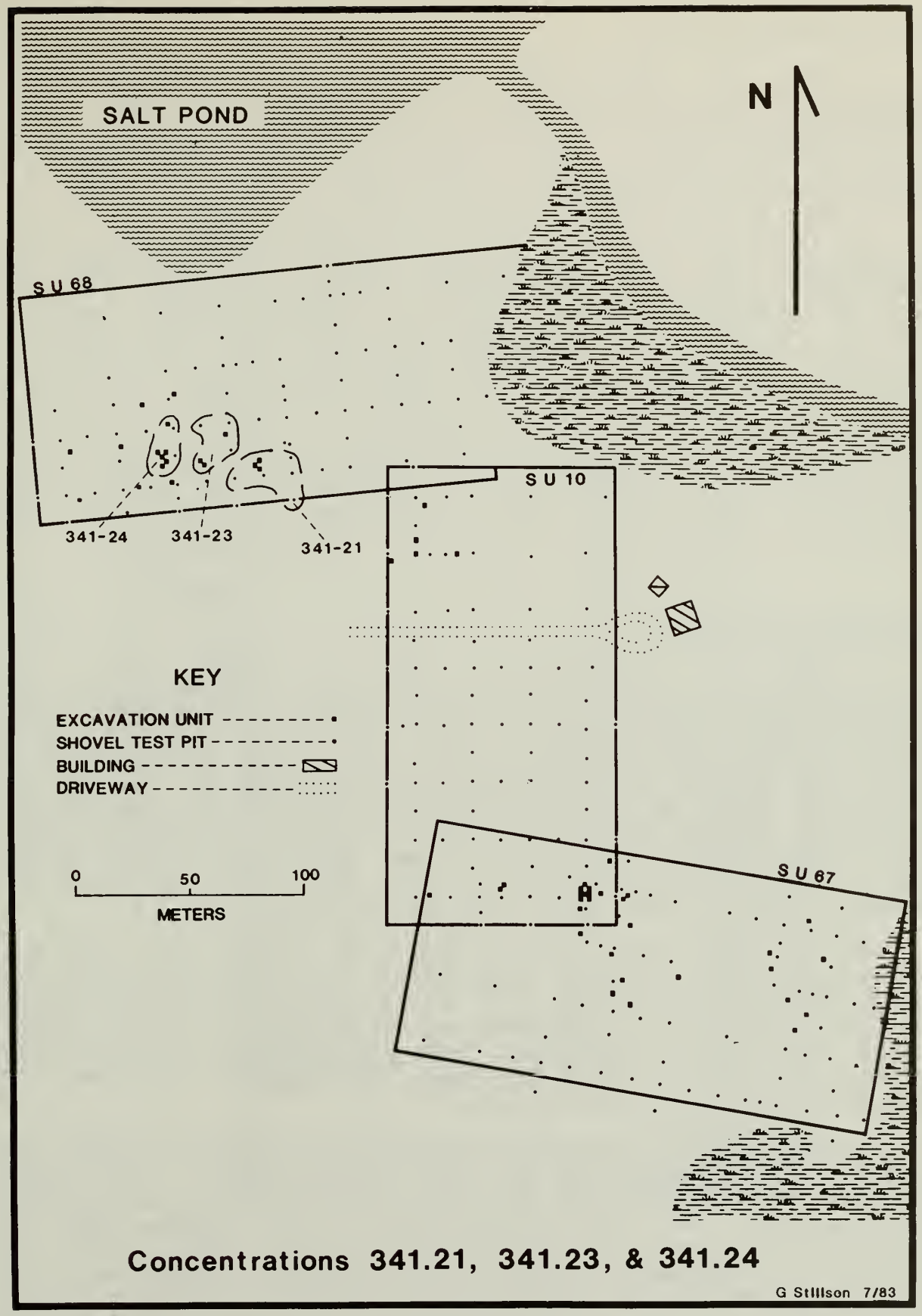
SALT POND
N
S U 68
341-24
341-23
341-21
S U 10
KEY
EXCAVATION UNIT
SHOVEL TEST PIT
BUILDING
DRIVEWAY
0
50
100
METERS
S U 67
Concentrations 341.21, 341.23, & 341.24
G Stillson 7/83

FIGURE 10.2

Concentration 341.23

A total of 227.1 grams of faunal remains were collected, primarily by hand excavation in the plowzone, from 1.5m x 1.5m Excavation Units 13, 16, and 18, and from Excavation Unit 9, .5m x .5m (Foldout Map E). Mammal bone from Excavation Units 13 and adjoining Excavation Unit 9 represented 93.4% of the total identified bone; including one deer tooth.

In Excavation Unit 13, midden fill from a number of shallow depressions in the subplowzone stratum was collected for flotation. Shell from these yielded radiocarbon dates of 1075 ± 115 B.P. (GX-9556) and 1110 ± 150 B. P. (GX-9557) (see Chapter 8). The presence of carbonized seeds in these small flotation samples (3,091 grams), in conjunction with dense clusters of pottery (see Chapter 14) and mammal bones around the area of Excavation Units 13 and 9, suggests a fairly intensive food-processing activity, and possibly the refuse from a nearby habitation area. Carbonized nut fragments also were recovered in this concentration. Bird and fish bone accounted for a minor portion of the total faunal assemblage; however, each was recovered in small amounts in 3 of the 4 excavation units.

Concentration 341.24

A total of 446.5 gams of bone was recovered by hand excavtion and flotation from a small cluster of excavation units. These included four adjoining .5 x .5m Excavation Units 1, 10, 11 and 12; four contiguous, or nearby, 1.5 x 1.5m Excavation Units 15, 19, 20 and 21; and one shovel test (Foldout Map E). Of the total 360 grams of identified bone, 74.9%, and virtually all of the floral remains came from, or were closely associated with, three features and one subplowzone shell lens (Table 10.10). Most of the remaining nonfeature bone was recovered from the plowzone above or near the truncated features.

Unlike other areas on the south side of Salt Pond, fish bone represented an unusually high 43.3% of the total identified faunal assemblage for Concentration 341.24 (Table 10.11). Within features, the relative abundance of fish bone was even higher, 57% of the total identified bone. Flotation of feature fill accounts for almost 85% of the total 155.9 grams of fish bone recovered from this concentration.

Of the total fish bone recovered, most (126.7 g) came from Feature 01 in Excavation Unit 15 (Table 10.10). The entire feature, as it was identified in the subplowzone, was collected for flotation. The hand-excavated bone in the plowzone above the feature was included with the Feature 01 bone, since most came from the ten centimeter level above the Feature. This feature is noteworthy because it contained 88.1% of the carbonized floral remains, 81.3% of the fish bone, 47% of the mammal bone and 23% of the bird bone for Concentration 341.24. Despite the large

TABLE 10.10
Description of Features Containing Floral Remains, 19BN341.24

Provenience	Stratum	Description	Dimensions	Flotation Data: Volume (ml)	Carb. Seeds (g)	Carb. Nuts (g)	Non-Carb. Seeds (g)	Faunal (g): B	F	M	Hand Exca. Faunal (g): B	F	M	Total Faunal (g)
EU 15, Fea. 01[a]	Subplowzone Mottled B horizon 36 cm B.D.	Truncated U-shaped pit feature	31 cm/d 29 cm thick	18,546	.65	.02	P	2.4	124	11.3	.5	2.7	77.8	218.7
EU 20, Fea. 01	Subplowzone Mottled B horizon 32 cm B.D.	Truncated posthole	15 cm/d 8 cm thick	714	.04	0	A	0	.1	0	0	0	0	.1
EU 21, Fea. 01	Subplowzone Mottled B horizon 32 cm B.D.	Truncated Basin-Shaped pit	22 cm/d 10 cm thick	555	*	0	P	0	0	0	0	0	0	0
EU 21, Fea. 02[b]	Subplowzone Mottled 36 cm B.D.	Shell Lens	Irregular	2,575	.01	.04	A	0	8.8	17.2	0	0	0	26.0
EUs 01, 10,11,12[c]	Subplowzone Mottled 29 cm B.D.	Truncated Irregular Rectanguloid pit	Ca. 40 cm/d Ca. 32 cm thick	No Flotation	-	-	-	-	-	-	.2	16.8	7.9	24.9
Total				22,390	.70	.06	-	2.4	32.9	28.5	.7	19.5	85.7	269.7

NOTES
B = Bird
F = Fish
M = Mammal
[a]C-14 date for charcoal from this provenience is 890 ± 150 B.P., a C-14 date for shell from the same provenience is 1090 ± 155 B.P., see Chapter 8.
[b]C-14 date for shell from this provenience is 1460 ± 155 B.P.
[c]C-14 date for shell from this provenience is 970 ± 120 B.P.
A = Absent
P = Present
* = Does not include occurrences of less than 0.01 g in total weight

TABLE 10.11

Relative Frequencies for Bird/Fish/Mammal, 19BN341
(from flotation and hand excavation)

Concent.	Total Fauna Identified To Class	% Bird	% Fish	% Mammal
341.21	610.8 g	6.4	8.9	84.7
.23	202.0 g	3.8	2.5	93.7
.24	360.0 g	3.5	43.3	53.2

volume of soil processed by flotation (18,546 ml), the combined volume of 13,000 ml from other flotation samples produced only 19.8% (.16 grams) of the carbonized seeds, and only 7.5% (10.1 grams) of the fish bone recovered by flotation (Table 10.10).

The basal subplowzone portion of this feature was symmetrical in profile, similar to the U-shaped storage pits identified by Ritchie (1969) on Martha's Vineyard. Although its original function could not be determined, its contents resembled a secondary trash deposit. The presence of burned and unburned bone and shell, carbonized seeds and nuts and a small amount of charcoal, in addition to a variety of other artifacts, including lithic flakes, pottery and fire-cracked rock, reflects refuse from a number of different activities. Associated artifacts, and two radiocarbon dates, on marine shell and charcoal, yielding an average date of 985 $\pm$ 110 B.P.(GX-9558; GX-9559), place the origin of this feature in the Late Woodland (see Chapters 8 and 14). The occurrence of nut shells and the density of carbonized seeds in Feature 01, Excavation Unit 15, suggested a summer and fall occupation. Unfortunately, seasonal determination could not be corroborated by seasonality studies of marine shells for this concentration.

Another, possibly contemporary, Late Woodland feature in Excavation Unit 12 (Table 10.10) contained a similar secondary refuse deposit. Marine shells from the irregularly-shaped pit feature yielded a radiocarbon date of 970 $\pm$ 120 B.P. (GX-9555) (see Chapter 8). Although this feature was first noticed 15 cm into the plowzone in Excavation Unit 1, it was identified and designated as a feature in the subplowzone soil of adjoining Excavation Unit 12, where only its most intact portion was excavated as a separate feature. This portion primarily contained shell, with some bone fragments, pottery, lithics and fire-cracked rock. Feature fill was not collected for flotation since the survey had not yet adopted a flotation technique; consequently, floral remains were not recovered. Instead, the feature fill, and most of the plowzone soil, from adjoining Excavation Units 1, 10, 11, and 12 was screened through 1/8 inch mesh to retain as much as possible of what excavators thought to be feature-related bone. Since a good portion of the feature had been truncated by plowing, bone from these adjoining units is included in the total weight value given for this feature. Together, these units contained 42.5 grams of bone; both bird and mammal were present, but fish bone represented 67.5% of the total identified bone.

A shell lens, designated Feature 02, in Excavation Unit 21, produced small amounts of carbonized seeds and nutshells and 26 grams of faunal remains (66.2% mammal and 33.8% fish).

In Excavation Unit 20, Feature 01 was a shallow, pointed depression defined in the subplowzone; a probable post hole. Primarily the fill contained shell, with some bone, lithics and carbonized seeds recovered by flotation. Although carbonized nut

fragments did not occur within the feature, 2.7 grams (96%) of the total weight for Concentration 341.24 were recovered in the general level encompassing the depression (Table 10.10).

In Concentrations 341.21, .23 and .24, where faunal material was most significant, bird, fish, and mammal bone co-occurred, with mammal bone being the most common. However, the high density of fish bone in Concentration 341.24 suggests a more specialized activity, specifically associated with deep pit features filled with secondary refuse deposits. Because fish remains are particularly unpleasant when left to decompose on the surface, the refuse associated with fish processing and/or consumption may have been segregated to an area away from the living site, perhaps to an area of old storage pits that had been abandoned. Since the remains most closely associated with food-processing, such as fire-cracked rock, charcoal and pottery, were not abundant, the food-processing activities and a possible habitation were probably located some distance from these features.

19 BN 288

This site encompasses approximately 31,000 square meters along the shore of Nauset Marsh, just east of Salt Pond (see Foldout Map F). As with other site areas, 19BN288 was tested with a systematic grid of shovel tests followed by both probability and judgmentally placed excavation units. The excavation units covered a small fraction of the total area; therefore, chances of locating features and recovering food refuse, such as small seeds, nuts and bones, may have been diminished by the limited number of excavation units spread across the site.

19BN288, Faunal Remains

Bone occurred primarily as small fragments within the plowzone. It was scattered in very low densities across a large portion of the site area but did not occur along the northeast perimeter (Figure 10.3). Only five of the sixteen concentrations that contained faunal remains had five grams or more of bone: Concentrations 288.33, .42, .22, .45, and .52.

Concentration 288.52 had by far the greatest faunal weight for all concentrations. The 60.9grams of remains were recovered by hand excavation from Excavation Units 9, 15, 16 and 17. A layer of fill in these units accounted for a small portion of the bone. Most of the bone was recovered from the buried plowzone, particularly in Excavation Units 16 and 17 where more than 50% of the bone was recovered. Of the total identified remains mammal bone accounted for 38.6%. The relative proportion of fish to mammal bone for the entire site was 27% to 73%, respectively. The higher occurrence of fish bone in Concentration .52 cannot be

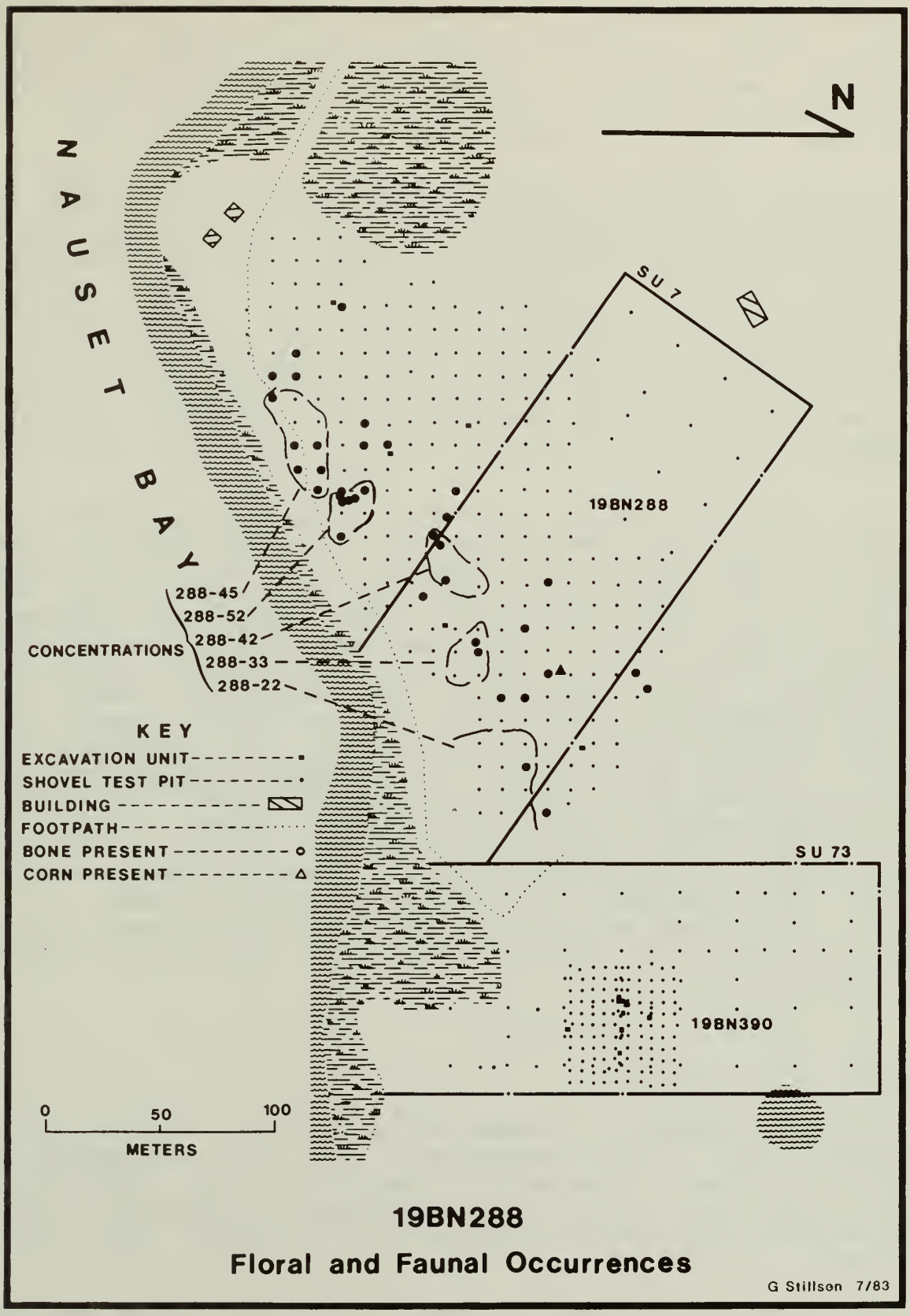
N
NAUSET BAY
SU 1
19BN288
SU 73
19BN390
288-45
288-52
288-42
288-33
288-22
CONCENTRATIONS
KEY
EXCAVATION UNIT
SHOVEL TEST PIT
BUILDING
FOOTPATH
BONE PRESENT
CORN PRESENT
0
50
100
METERS
19BN288
Floral and Faunal Occurrences
G Stillson 7/83

FIGURE 10.3

attributed to a specific feature, nor can can it be attributed to flotation since no flotation samples were collected. With the exception of Concentration .52, bone density at 19BN288 appeared relatively low compared to other sites around Salt Pond. Bird bone was virtually absent at this site, and generally fish and mammal bone co-occurred (Table 10.12).

It seems doubtful that poor preservation can be blamed for the low amounts of bone recovered in hand excavations or for the complete absence of bird bone at this site. First, shell remains were relatively dense (more than double the combined shell density for 19BN273/75, 274/339, 340 and 341) and these occurred widely across the site area. Since shell has a buffering effect in acidic soil, the preservation of bone, if it were present, should have been relatively good. Second, negligible evidence of small faunal remains from the single flotation sample, collected from Concentration 288.11, Excavation Unit 7, Feature 01, tends to support the low density of bone recovered from hand excavations at this site.

Nearly 46% (99.5 grams) of the total bone by weight from 19BN288 (Table 10.13) was composed of a few fragments of bone tentatively identified as sea mammal (recorded in the category "other"). Sea mammal bones of this size and weight were relatively rare in all other sites. These bones were recovered from Shovel Test 1181 in the plowzone/slopewash stratum at the base of a kettle. This unit is outside of any site concentration. Visual comparison with whale bone remains from the Great Island Tavern Site, located in Wellfleet, suggests that the bone from the shovel test is denser and therefore more similar to seal bone. Harbor seals (Phoca vitulina concalor) winter in southern New England where they are often seen up on the rocks and sandbars (Godfrey 1976:vi-2). However, since their identification is speculative, and since Cape Cod is in the path of other migratory sea mammals, these fragments presently do not support the assignment of a particular season of death for the remains. Winter was determined to be the season of death for a number of shellfish specimens from nearby Concentration 288.33 (see Chapter 12).

19BN288, Floral Remains

During excavation in Concentration 288.11, Feature 01 in Excavation Unit 7 was tentatively identified as cultural and collected as a soil sample for flotation. The 3,568 ml of feature flotation soil yielded .08 grams of carbonized seeds, a comparatively high density, considering the small soil volume processed.

In Concentration 288.31, hand excavation in the plowzone stratum yielded two carbonized kernels of eight-rowed Northern Flint corn--Maize de Ocho (Galinat, personal communication) and a few carbonized cob fragments, in Excavation Unit 14. The

TABLE 10.12

Most Common Occurring Faunal Associations, 19BN288

Concentrations	Fish	Mammal
288.11	X	X
.22	X	X
.33	X	X
.41	X	X
.42	X	X
.45	X	X
.51	-	X
.52	X	X
.53	-	X
.54	X	X
.57	X	X
.00	X	X
	9	9

NOTES

X = Presence of category

TABLE 10.13a: Floral and Faunal Remains, 19BN288

Hand Excavated

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
288.11	1,289,567	0	0	0	0	*	0	0	0	0
.21	270,000	0	0	4.4	0	0.4	4.8			
.22	479,026	0	0.7	3.4	0.2	1.3	5.6	0	0	0
.23	207,571	0	0.2	0	0	0.1	0.3	0	0	0
.31	936,270	0	0	0	0	1.5	1.9	**0.60	0	0
.33	372,445	0	0.2	5.3	6.2	1.1	12.8	0	0	0
.34	159,927	0	0	0	1.1	0	1.1	0	0	0
.41	1,097,272	0	0	1.1	0	0.2	1.3	0	0	0
.42	546,290	0	0.9	*12.8	0	0	13.7	0	0	0
.45	320,289	0	0.6	6.3	0	1.2	8.1	0	0	0
.51	468,896	0	0	0.3	0	0	0.3	0	0	0
.52	1,185,702	0	16.8	26.7	2.0	15.4	60.9	0	0	0
.53	359,970	0	0	1.5	0	0	1.5	0	0	0
.54	227,115	0	0.2	0.1	0	0.2	0.5	0	0	0
.55	310,349	0	0.2	0.2	0	0.1	0.5	0	0	0
.57	595,797	0	2.9	1.7	0	0	4.6	0	0	0
.00	4,213,885	0	1.1	0.1	99.5	0.2	100.9	0	0	0
Totals	17,106,630	0	23.8	63.9	109.0	21.7	218.8	0.60	0	0

TABLE 10.13b: Floral and Faunal Remains, 19BN288

Flotation

Conc.	Total Volume Excavated(cm^3)	Bird (g)	Fish (g)	Mammal (g)	Other (g)	Unident. (g)	Total Faunal (g)	Carb. Seeds (g)	Carb. Nuts (g)	Noncarb. Seeds (g)
288.11	3,568	0	*	0	0	*	0	*0.02	0	0
.22										
.23										
.31										
.33										
.34										
.41										
.42										
.45										
.51										
.52										
.53										
.54										
.55										
.57										
.00										
Totals	3,568	0	*	0	0	*	0	*0.02	0	0

NOTES:

P = Present

* = Does not include occurrences of less than 0.01 g in total weight

** = 2 corn kernels and cob fragments

plowzone provenience of the maize leaves its temporal association uncertain, because New England colonists were also cultivating Indian maize by 1627 (Ceci 1979). However, since the associated plowzone artifacts overwhelmingly represented a prehistoric rather than Colonial occupation, the context supports the association of prehistoric native horticulture with the maize.

The kernels are crescent-shaped (without dents) and have greater width than depth. One complete kernel measures in width 10.5mm, and in length 6.5mm, which corresponds in size to the archeological kernels from the Bowman Brook site, considered to be full-sized, mature specimens (Ceci 1979:50-51). In New York state the earliest dated (A.D. 1070 ± 60) eight-rowed corn was recorded at the inland Round Top site (Ritchie and Funk 1973:179-194). In Massachusetts, the earliest recorded date is A.D. 1160 ± 80 (Ritchie 1969:52) for the Hornblower II site on Martha's Vineyard. Determining season of occupation based on the time of harvest assumes maize was not carried onto the site, but rather that it was used and/or stored on the site in the same season that it was collected. Depending on frost conditions mature maize could have been harvested on Cape Cod as early as September or as late as early November.

Considering the floral and faunal data from 19BN288, the most definitive seasonal indicator at this time is the mature maize kernel suggestive of a fall occupation and activities in the area of Concentration 288.31. The paucity of bird bone, in conjunction with the fall indicator and the nearby marsh, is curious. Because migratory fowl are presently most abundant in the marsh, in the spring and fall, one would expect to find evidence of bird remains associated with a fall occupation. Some possible explanations for the negative bird/maize association are:

(1) a conflict in fall scheduling with the maize resource overriding the fowl resource.

(2) fowl remains deposited and/or processed elsewhere, possibly at another location.

(3) corn deposited at this site took place when fowl were least available: in the winter.

Number 3 is supported by the shellfish season of death and could temper the fall indicator based on the mature maize. On the other hand, it may be that the maize association is simply an indication that the area was occupied during several seasons.

Summary

In general, faunal and floral recovery was greater in the dense general middens (McManamon 1983:238-245) at 19BN308 and

341, where shell density ranked high compared to the overall project area densities. However, faunal and floral resources may have been more common in other areas than the data suggest, but have not been recognized because of their unobtrusiveness and poor preservation.

In the middens where floral and faunal resources were recovered the exploitation of both terrestrial and marine environments is represented. Considering the variety of terrestral animals represented in the faunal assemblage and the presence of large mammals, most likely deer, exploitation might have occurred throughout the year, aided by task groups travelling some distance from the immediate marine environment (see Chapter 16).

Unlike the other middens around Nauset Bay, 19BN288 primarily represented a single marine resource-- shellfish. Even though preservation would have been high within the dense shell midden, other faunal and floral remains were extremely rare. Seasonality studies, based on the season of death for a majority of the shellfish specimens analyzed, suggest that the predominant season of collection at this site was the winter. The site's distance from the open Bay and proximity to a large kettle hole, offering protection from the northeast winds, also support a winter occupation. Seasonality, therefore, is perhaps the best explanation for the observed differences in resource utilization at this site compared to the other more varied midden deposits around Nauset Bay. Other sites showed evidence of a wider range of economic activities including: fishing, hunting, shellfish collecting and gathering of wild plant resources. At least one of these activities showed intra-site spatial organization concerning the discarding and/or processing of fish remains. Although fish remains were common in the small dumping episodes and in the larger surface midden, they were never as abundant as in the deep pit features at 19BN341 and 19BN308. These suggest a particular disposal pattern for abundant fish remains and, in turn, may also be related to a specific season of abundance; possibly a particular species of fish.

Finally, there is specific evidence for horticulture at 19BN390, 19BN323, and 19BN288 based on a few kernels of Northern Flint corn, as well as at the corner of Nauset Bay, from the early seventeenth century ethnohistoric accounts of Champlain and the Pilgrims (see Chapter 6). Although there is no evidence to suggest that horticulture ever displaced hunting, gathering, and collecting around Nauset Bay, there is an indication that horticulture may have become progressively more important throughout the Woodland Period. This is suggested by a shift in seasonal shellfish collection periods away from summer to winter exploitation. According to McManamon (1983:322; Chapter 16) this may reflect a scheduling choice whereby summertime planting and gardening superseded summertime shellfish collection.

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CHAPTER 11

Shellfish Distribution on Prehistoric Archeological Sites, Outer Cape Cod

Mary E. Hancock

Introduction

A large number of sites identified during archeological survey and testing in the Outer Cape Cod region contained sizeable deposits of shell middens. Archeological deposits with clearly visible shellfish remains typically are referred to as "shell middens"; this term is used in this chapter also. Readers should note, however, that in Chapter 16, which synthesizes much of the data in this report, archeological middens are divided into shell middens and general middens. The latter are distinguished by more diverse remains, often including substantial shell, than the former.

Shell middens have been observed in many coastal areas throughout the world and are associated with both historic and prehistoric archeological sites. For example, Mesolithic shell middens are common along northern European coasts (e.g. Bailey 1978; Cohen 1977) and in the New World middens associated with Formative and Ceramic period sites in Central and South America have been reported (e.g., Moseley 1975; Stark and Voorhies 1978). Sizeable middens on the east and west coasts of North America have been observed and studied (e.g. Cook 1946; Keen 1973; Braun 1974; Sanger 1979, 1981).

Shell middens are of interest to archeologists for a number of reasons. Shellfish remains contribute to subsistence analyses (e.g., diet) and seasonality studies (see Chapter 12, this report and references cited therein). Middens contain other forms of organic refuse (e.g., bones and seeds), the preservation of which is enhanced due to the soil alkalinity produced by shell decomposition. Although the need for sampling methods and analyses appropriate to the unique depositional environment of shell middens has been recognized (e.g., Sanger 1981), many of

these efforts are still in their formative stages. Such efforts are essential to the development of processual and cultural historical models like those suggested by Perlman (1980), Sanger (1982) and Yesner (1980).

The material presented and discussed in this chapter represents part of the "baseline" reserach necessary for the development of more general models of coastal settlement and subsistence. Data consist of weights and estimates of numbers of individuals represented in shell collections for sites, concentrations and features. These were tabulated to yield species distributions within these various locational classes. A number of objectives guided the research: (1) determination of the relative importance of various species of shellfish recovered, (2) assessment of variation in species distribution within and between sites and (3) compilation of data to be used in more thorough future analyses of subsistence and settlement in this region.

Local Availability of Shellfish

The shellfish species identified in sites from the survey area have broad latitudinal ranges roughly from Labrador or Nova Scotia to Cape Hatteras and occasionally further south (Whitlach 1982). Although shellfish are found in many intertidal locations on the Outer Cape, prehistoric sites were not located in close proximity to present day zones of maximum abundance and/or diversity, based on 1978 Survey of Shellfish Resources of the Massachusetts coast (Massachusetts Office of Environmental Affairs, 1978). Nevertheless, in the areas of prehistoric site location, many species are available, though in lesser quantities than in present day commercially important areas. Bivalve species found on prehistoric sites examined by the survey include, in order of abundance: Mercenaria mercenaria (quahog or hard-shelled clam), Mya arenaria (soft-shelled clam), Crassostrea virginica (American oyster), Argopecten irradians (Atlantic bay scallop), Spisula solidissima (Atlantic surf clam), Ensis directus (razor clam) and Mytilus edulis (blue mussel). Edible marine gastropods were widely distributed, though their densities were very low; they included Busycon canaliculatum (channeled whelk), Polinices duplicatus (moon snail), Nassarius obsoletus (mud whelk) and Crepidula fornicata (slipper shell). Identifications were made with the aid of Abbott (1974), Emerson and Jacobson (1976) and Gosner (1971).

The bivalves have an obvious dietary role; this is supported by ethnohistorical evidence (e.g., Martin 1970). It is possible that the gastropods were collected for consumption, though their low incidence suggests that they were of little dietary importance overall. Such species have commonly been used

as bait; some may have been inadvertently collected with other bivalves or transported to the site are by other animals, such as seagulls (Barber 1982:61-62).

Both M. mercenaria and M. edulis were observed in abundance in intertidal areas throughout Nauset Bay. The former are found most frequently in sandy inter- and subtidal zones in the estuary, whereas the natural occurrence of M. edulis is limited to rocky intertidal areas (Abbott 1974; Ansell 1968; Lutz 1976). Mya arenaria also were noted, though they tend to cluster in the muddier intertidal areas (Belding 1930; Whitlach 1982). Spisula solidissima was observed less frequently, though it is common in the sandy sub-tidal zone.

The above species tended to be found on most sites that were tested. Other species were unevenly distributed: Argopecten irradians and Crassostrea virginica were recovered in large quantities at a limited number of concentrations in a few sites (i.e., 19BN308, 323, 390 and 410). The shells of the latter species are more friable than those of quahog or soft-shelled clam; this can have a significant, but non-measurable, effect on species representation. Argopecten irradians are found subtidally and offshore. Unlike the other bivalve species mentioned they are neither infaunal nor sedentary, but are capable of locomotion. Present day exploitation methods include dragging: aboriginal exploitation techniques are unknown though for bulk collections it may have been necessary to use a weir-type device with closely meshed nets.

The distribution of Crassostrea virginica on the Northeast North American coast has fluctuated during the past 2000 years (Braun 1974; Myers 1965). In addition, oyster communities are highly localized, due to life habits and environmental requirements (Galtsoff 1964). It is, therefore, difficult to speculate on the location of oyster beds prehistorically, based on modern distributional data. We do know that the Outer Cape offers several favorable microhabitats, such as Wellfleet Bay where oysters have flourished historically, and Pleasant Bay, where they have been successful in recent years. Consequently, although they have not been observed in abundance in Nauset Bay recently, it is likely that they were accessible there or nearby during at least some prehistoric periods.

The availability of bivalves in the High Head and Provincelands region is presently more restricted than in Nauset Bay. As has already been suggested, shellfish availability contemporaneous with site occupation isn't necessarily identical with that of the present; the quantity of remains (C. virginica, largely) at 19BN410 provides a case in point. Small quantities of shellfish are transportable and, depending on site function, it may not have been necessary or desirable to be located adjacent to shellfish beds.

The final point may be a useful consideration in assessing information about subsistence and settlement patterns, especially when weighing information on shellfish remains. The prehistoric sites on the outer Cape have variable quantities of shell though these amounts do not correlate, in every case, with the availability of shellfish in the site area. Shellfish constitute a dependable and easily exploitable source of protein and other nutrients; they may be a dietary staple during lean periods or a dietary supplement at other times (e.g. see Bigalke 1973; Claasen 1982; Meehan 1977a and 1977b). Relatedly, intertidal areas often support a rich floral and faunal community of which shellfish are only one component. Consequently, the importance of shellfish is mediated by several factors, including the presence of other available foods, exploitation methods, social factors affecting division of labor and the location and duration of settlement. All these should be borne in mind when interpreting shellfish remains. Some of these factors will be discussed in other sections of this chapter.

Methods

Data discussed herein are those analyzed and compiled prior to August 10, 1982. They represent material recovered during survey and testing phases of the Cape Cod National Seashore archeological project conducted during 1979 and 1981. In the majority of cases, shell deposits encountered during these operations were removed in toto. At a few sites, the large amount of shell found dictated that some type of sampling procedure be used to recover representative quantities of shell. Sampling procedures were varied and included column samples (average dimensions ranged between level depth x 15 cm x 15 cm and level depth x 25 cm x 25 cm), and a "bucket subsample" approach. The latter was devised for excavating an especially thick and dense midden in Concentration .33 at 19BN308. All material from a given level was divided equally among 14 buckets (actual volumes varied given depth of the levels which were natural rather than arbitrary). Four buckets were randomly selected for further examination. Three were screened (1/4" mesh); artifactual, faunal and floral materials were removed and bagged for cataloguing and further analysis. Shell recovered via this method was treated in the same manner as other excavated shell (discussed below). The fourth bucket was floated in the laboratory. Flotation techniques and cataloguing procedures for floral and faunal remains are described in Chapter 10.

In general, I have included flotation data when available in the tables. Most features, for example, were usually removed completely, hence most qualitative and quantitative data pertaining to features have been derived from

analysis of flotation residue. The same applies to column samples. Flotation recovery and analysis were not complete as of August 1982, accordingly a number of proveniences are underrepresented. I have noted these cases in the site summaries.

Shell collected during excavation was bagged and labeled in the field. It was later cleaned, sorted and cataloged in the laboratory. Shells larger than 1/2 inch in diameter were identified according to species; their respective weights were recorded. Weights of the remainder (<1/2 inch) were taken and noted as "Mixed species; <1/2 inch." For the bivalved species, number of right and left valves were recorded; for univalves numbers of whole (or nearly whole) shells were recorded. As can be observed in the data below, there is, in some cases, a great deal of intra-site diversity among species represented. This variation is significant, inasmuch as it may contribute to inferences about stratification and depositional history as well as the reconstruction of subsistence and settlement processes. The latter is aided further by information about season of exploitation.

Shell recovered via flotation was divided into categories based on size. As above, species of shells having diameters larger than 1/2 inch were identified, smaller fragments were weighed and recorded merely as "shell."

In the following section, summaries of distribution of shell species per site are presented. Original weight data have been tabulated for site, concentration and stratum and are presented in a series of tables. Sub-totals of species represented in features included in concentrations also are presented where those data are available.

In addition to weights per species, I have attempted to estimate the number of individuals represented by the given weights for the more important species, i.e., Mercenaria mercenaria, Crassostrea virginica, Mya arenaria, and Argopecten irradians. I determined a mean shell weight per individual by weighing whole shell recovered at various sites: Mercenaria mercenaria 6 g, Crassostrea virginica 10 g, Mya arenaria 3 g, Argopecten irradians 2 g. The net species weights were divided by these figures to arrive at the estimated number of individuals represented by that weight. This is not intended as a formal MNI calculation, because I have not taken size variation inherent in the original samples into account. It is, rather, an informal index to the weights. The individual shell weights of different species vary a great deal; by comparing weights only, one may get a skewed impression of the relative proportions of animals actually present. For example, identical weights of quahogs and soft-shelled clams are the products of highly divergent numbers of individuals. By trying to give some estimate of the number of individuals represented by a given shell weight, I hope to allow

a broader basis for comparison and more accurate estimations of species distribution.

Site Summaries

Fort Hill (Foldout Map D)

Site 19BN308 was fairly extensive and contained a number of dispersed, thick midden deposits. The depositional history of the site is complex; this is reflected by the observed variation among middens in different excavation units. In some excavation units (e.g. 108 and 112), discrete shell lenses, predominated by particular species, were noted (and labeled and excavated as features). In others, no discrete shell lenses were observed and shells of all species and associated refuse were mixed. As reference to Table 11.1 indicates, species diversity and overall shell density varied among concentrations and strata.

In some cases, high shell density precluded complete collection and sampling methods were used. The "bucket sub-sampling method described in the preceding section was devised for particular excavations.

19BN308 yielded high quantities of shell overall. As on other sites, with the exception of 19BN390, weights (33.5% of the site total) and estimated number of individuals (23,299) of M. mercenaria generally exceeded those of the other important species. The latter included Mya arenaria (11.3% of total weight; 15,705 estimated individuals), Crassostrea virginica (9.9% tot. wgt.; 4125 est. ind.) and Argopecten irradians (.7% tot. wgt.; 1245 est. ind.).

These three species were not distributed as extensively as Mercenaria mercenaria; however, in certain features, one or more of these species constituted the bulk of remains. As was noted above, this was one of the few sites where discrete shell lenses of one or two species were found in situ. These deposits will be discussed briefly below.

A final general observation may be made with regard to the shell density and species distribution per stratum. Contrary to most of the other sites discussed in this report, the overall shell density in Stratum II is significantly higher (over 30%) than that of Stratum I. In addition, the relative proportions of the four major species are closer in Stratum II than in Stratum I where M. mercenaria far outweighs other species.These observations suggest two inferences. First, the archeological deposits at 19BN308 may be deeper than in other sites, and have not been as damaged by plowing. Second, the predominance of M. mercenaria in Stratum I, usually the plowzone, may result from

TABLE 11.1 page 1

SHELLFISH SPECIES	1980308 Total Stretch 11 Weight (g)	1980308 Total Stretch 11 % Total Weight	1980308 Total Stretch 11 Number of Individuals	308.11 Weight (g)	308.11 % Total Weight	308.11 Number of Individuals	308.12 Weight (g)	308.12 % Total Weight	308.12 Number of Individuals
M. mercenaria	139796.0	33.5	23299	8251.8	57.0	1375	2406.1	51.4	401
C. virginica	41251.3	9.9	4125	3.0	0.02	--	--	--	--
M. arenaria	47115.1	11.3	15705	141.8	0.9	47	53.2	1.1	17
E. directus	103.1	0.02	--	1.4	0.07	--	--	--	--
A. irradians	2940.7	0.7	1245	--	--	--	--	--	--
S. solidissima	1249.0	0.3	--	9.6	0.06	--	21.5	0.46	--
M. edulis	52.6	0.01	--	--	--	--	--	--	--
B. canaliculatum	1056.3	0.2	--	11.3	0.08	--	12.5	0.3	--
C. fornicata	208.5	0.05	--	0.3	0.002	--	--	--	--
N. obsoletus	246.0	0.06	--	20.1	0.1	--	1.0	0.02	--
P. duplicetus	160.8	0.04	--	13.2	0.09	--	5.4	0.1	--
Unidentified	3712.5	0.9	--	277.4	1.9	--	67.1	1.4	--
Less than ¼ inch	178780.9	42.9	--	5740.5	39.7	--	2113.6	45.1	--
Totals	416672.8			14470.4			4680.4		

TABLE 11.1 page 2

SHELLFISH SPECIES	308.21 Weight (g)	308.21 % Total Weight	308.21 Number of Individuals	308.21, Stratum II (actual amount recovered) Weight (g)	308.21, Stratum II (actual amount recovered) % Total Weight	308.21, Stratum II (actual amount recovered) Number of Individuals	308.21, Stratum II (estimated total amount) Weight (g)	308.21, Stratum II (estimated total amount) % Total Weight	308.21, Stratum II (estimated total amount) Number of Individuals
M. mercenaria	4108.4	33.5	684	3783.5	41.5	630	39428.3	69.8	6571
C. virginica	1.3	0.01	--	0.6	0.01	--	0.6	0.001	--
M. arenaria	451.8	3.7	150	1828.4	20.04	609	2447.6	4.3	815
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	0.4	0.004	--	2.0	0.003	1
S. solidissima	12.3	0.1	--	22.8	0.2	--	22.8	0.04	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	2.6	0.02	--	2.6	0.004	--
C. fornicate	--	--	--	1.7	0.1	--	1.7	0.002	--
N. obsoletus	8.7	0.07	--	68.7	0.7	--	105.5	0.2	--
P. duplicetus	8.7	0.07	--	12.0	0.13	--	12.0	0.02	--
Unidentified	166.3	1.3	--	22.0	0.24	--	449.5	0.8	--
Less than ¼ inch	2895.2	23.6	--	3379.9	37.04	--	14012.9	24.6	--
Totals	12243.9			9122.6			564855		

SHELLFISH SPECIES	308.13 Weight (g)	308.13 % Total Weight	308.13 Number of Individuals	308.14 Weight (g)	308.14 % Total Weight	308.14 Number of Individuals	308.15 Weight (g)	308.15 % Total Weight	308.15 Number of Individuals
M. mercenaria	10.8	35.2	1	21576.6	79.9	3596	280.2	33.0	46
C. virginica	--	--	--	3.1	0.01	--	19.9	2.3	2
M. arenaria	--	--	--	264.0	0.9	21	58.2	6.9	19
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	19.6	2.3	10
S. solidissima	--	--	--	4.7	0.02	--	1.7	0.2	--
M. edulis	--	--	--	10.0	0.04	--	--	--	--
B. canaliculatum	--	--	--	38.1	0.14	--	0.6	0.07	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	19.1	0.07	--	--	--	--
P. duplicetus	--	--	--	3.2	0.01	--	--	--	--
Unidentified	7.4	24.2	--	80.1	0.29	--	17.0	2.0	--
Less than ¼ inch	12.4	40.5	--	4991.5	18.5	--	451.0	53.2	--
Totals	30.6			26990.4			848.2		

SHELLFISH SPECIES	308.21, Stratum II (feature contents only) Weight (g)	308.21, Stratum II (feature contents only) % Total Weight	308.21, Stratum II (feature contents only) Number of Individuals	308.22 Weight (g)	308.22 % Total Weight	308.22 Number of Individuals	308.23 Weight (g)	308.23 % Total Weight	308.23 Number of Individuals
M. mercenaria	1315.6	43.7	219	1103.0	50.0	183	51.9	30.7	8
C. virginica	2.6	0.09	--	--	--	--	--	--	--
M. arenaria	1435.2	47.7	478	17.0	0.8	5	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	1.7	0.06	--	--	--	--	--	--	--
C. fornicate	0.2	0.01	--	--	--	--	--	--	--
N. obsoletus	14.4	0.5	--	1.1	0.05	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Uoidentified	4.4	0.1	--	38.8	1.8	--	9.4	5.5	--
Less than ¼ inch	233.4	7.8	--	1044.2	47.4	--	107.8	63.7	--
Totels	3007.5			2204.1			169.1		

TABLE 11.1 page 3

SHELLFISH SPECIES	308.26 Weight (g)	308.26 % Total Weight	308.26 Number of Individuals	308.27 Weight (g)	308.27 % Total Weight	308.27 Number of Individuals	308.31 Weight (g)	308.31 % Total Weight	308.31 Number of Individuals
M. mercenaria	6.8	64.8	1	25.11	50.8	4	114.7	57.2	19
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	---	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irrediens	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	4.8	9.8	--	0.3	0.14	--
Less thao ¼ inch	3.7	35.2	--	19.5	39.5	--	85.5	42.6	--
Totals	10.5			49.4			200.5		

TABLE 11.1 page 4

SHELLFISH SPECIES	308.33, EU 300 (estimated total amount) Weight (g)	% Total Weight	Number of Individuals	308.33, EU 300 Feature 01 Weight (g)	% Total Weight	Number of Individuals	308.33, EU 300 Feature 02 Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	107728.0	37.1	17959	242.3	72.9	40	35.7	68.0	5
C. virgioica	49325.0	16.9	4932	--	--	--	--	--	--
M. arenaria	38694.0	13.3	12898	89.8	27.1	29	16.8	32.0	5
E. directus	201.0	0.07	100	--	--	--	--	--	--
A. irrediane	171.0	0.06	--	--	--	--	--	--	--
S. solidissima	61.0	0.02	--	--	--	--	--	--	--
M. edulis	0.5	0.002	--	--	--	--	--	--	--
B. canaliculatum	91882.5	31.6	--	--	--	--	--	--	--
C. fornicata	1490.0	0.5	--	--	--	--	--	--	--
M. obsolatus	535.0	0.2	--	--	--	--	--	--	--
P. duplicatus	205.5	0.07	--	--	--	--	--	--	--
Unidentified	199.5	0.07	--	--	--	--	--	--	--
Less than ¼ ioch	--	--	--	--	--	--	--	--	--
Totals	290483.0			332.1			52.5		

SHELLFISH SPECIES	308.32 Weight (g)	% Total Weight	Number of Individuals	308.33 (excluding EU 300) Weight (g)	% Total Weight	Number of Individuals	308.33, EU 300 (actual amount recovered) Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	816.3	30.4	136	18528.6	38.4	3088	33110.2	38.4	5518
C. virgioica	--	--	--	5399.6	11.2	539	13968.4	16.2	1396
M. arenaria	510.0	19.0	170	5659.7	11.7	1886	9844.5	11.4	3281
E. directus	--	--	--	10.7	0.02	--	51.0	0.06	85
A. irradians	--	--	--	4.8	0.01	2	51.6	0.06	25
S. solidissima	--	--	--	270.7	0.6	--	163.0	0.2	--
M. edulis	23.5	0.9	--	--	--	--	0.1	0.007	--
B. canaliculatum	26.1	1.0	--	51.2	0.1	--	319.4	0.4	--
C. fornicate	--	--	--	16.8	0.03	--	119.3	0.1	--
M. obsoletus	0.7	0.03	--	39.6	0.08	--	41.1	0.05	--
P. duplicatus	0.9	0.03	--	3.2	0.006	--	46.3	0.05	--
Unidentified	30.5	1.1	--	545.4	1.1	--	285.0	0.3	--
Less than ¼ ioch	1275.7	47.5	--	17651.2	36.6	--	28152.1	32.7	--
Totals	2683.7			48181.5			86152.0		

SHELLFISH SPECIES	308.33, EU 300 Feature 04 Weight (g)	% Total Weight	Number of Individuals	308.33, EU 300 Feature 05 Weight (g)	% Total Weight	Number of Individuals	308.33, EU 300 Feature 09 Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	106.8	45.4	17	547.3	71.0	91	538.1	64.0	95
C. virgioica	--	--	--	88.9	11.5	8	228.5	27.2	23
M. arenaria	128.6	44.6	42	133.3	17.3	44	74.6	8.9	24
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	0.8	0.1	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Uoidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	---	--	--	--	--	--	--	--	--
Totals	235.4			770.3			841.2		

TABLE 11.1 page 5

SHELLFISH SPECIES	308.34 Weight (g)	308.34 2 Total Weight	308.34 Number of Individuals	308.35 Weight (g)	308.35 2 Total Weight	308.35 Number of Individuals	308.41 Weight (g)	308.41 2 Total Weight	308.41 Number of Individuals
M. mercenaria	139.0	63.5	23	713.8	65.2	118	570.1	60.7	95
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	3.6	1.6	1	27.2	2.5	9	--	--	--
E. directus	--	--	--	1.3	0.1	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	31.2	2.8	--	--	--	--
P. duplicatus	--	--	--	13.2	0.2	--	46.3	4.9	--
Unidentified	76.3	34.8	--	307.4	28.1	--	322.5	34.3	--
Less than ½ inch	--	--	--	--	--	--	--	--	--
Totals	218.9			1094.1			938.9		

TABLE 11.1 page 6

SHELLFISH SPECIES	308.43 Weight (g)	308.43 1 Total Weight	308.43 Number of Individuals	308.43, Stratum II Weight (g)	308.43, Stratum II 2 Total Weight	308.43, Stratum II Number of Individuals	308.51 Weight (g)	308.51 2 Total Weight	308.51 Number of Individuals
M. mercenaria	158.7	86.5	26	11.6	31.7	1	664.5	44.1	110
C. virginica	--	--	--	--	--	--	408.5	27.1	40
M. arenaria	17.2	9.4	5	9.6	26.2	3	3.9	0.3	1
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	0.4	0.03	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	17.1	1.1	--
C. fornicate	--	--	--	--	--	--	3.7	0.2	--
M. obsoletus	--	--	--	--	--	--	3.5	0.2	--
P. duplicatus	--	--	--	--	--	--	1.6	0.1	--
Unidentified	2.2	1.2	--	--	--	--	64.0	4.2	--
Less then ½ inch	5.4	2.9	--	15.4	42.1	--	338.0	22.4	--
Totals	183.5			36.6			1505.2		

SHELLFISH SPECIES	308.42 Weight (g)	308.42 2 Total Weight	308.42 Number of Individuals	308.42, Stratum I2 Weight (g)	308.42, Stratum I2 2 Total Weight	308.42, Stratum I2 Number of Individuals	308.42, Stratum I1 (feature contents only) Weight (g)	308.42, Stratum I1 2 Total Weight	308.42, Stratum I1 Number of Individuals
M. mercenaria	12795.0	48.3	2132	5761.1	3.5	960	4886.4	10.6	814
C. virginica	37.3	0.1	3	21217.6	15.1	2121	10986.9	20.2	1098
M. arenaria	2401.6	9.1	800	22295.7	15.9	7431	1433.9	2.6	477
E. directus	0.6	0.002	--	29.9	0.02	--	5.0	0.01	--
A. irradians	4.2	0.01	2	2814.4	2.0	1407	2630.1	4.8	1315
S. solidissima	75.1	0.3	--	598.1	0.4	--	83.3	0.15	--
M. edulis	--	--	--	15.0	0.01	--	42.6	0.07	--
B. canaliculatum	75.3	0.3	--	284.2	0.2	--	11.9	0.02	--
C. fornicate	0.8	0.003	--	57.3	0.04	--	--	--	--
M. obsoletus	1.6	0.006	--	20.4	0.01	--	--	--	--
P. duplicatus	1.8	0.007	--	18.7	0.01	--	--	--	--
Unidentified	373.7	1.4	--	1020.5	0.7	--	130.3	0.2	--
Less than ½ inch	10705.1	40.4	--	86997.8	62.0	--	33159.7	61.1	--
Totals	26472.1			140256.0			54244.8		

SHELLFISH SPECIES	308.51, EU 200 Feature 01 Weight (g)	308.51, EU 200 Feature 01 2 Total Weight	308.51, EU 200 Feature 01 Number of Individuals	308.71 Weight (g)	308.71 2 Total Weight	308.71 Number of Individuals	308.71, Stratum II Weight (g)	308.71, Stratum II 2 Total Weight	308.71, Stratum II Number of Individuals
M. mercenaria	328.1	30.3	54	458.5	60.1	76	20682.6	56.6	3447
C. virginica	394.4	36.4	39	--	--	--	93.6	0.3	9
M. arenaria	--	--	--	58.0	7.6	19	3179.7	8.7	1059
E. directus	--	--	--	--	--	--	8.2	0.02	--
A. irradians	0.4	0.04	--	--	--	--	--	--	--
S. solidissima	--	--	--	2.7	0.3	--	66.8	0.2	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	17.1	1.6	--	--	--	--	35.9	0.1	--
C. fornicata	3.7	0.3	--	--	--	--	8.6	0.02	--
M. obsoletus	--	--	--	--	--	--	20.6	0.06	--
P. duplicatus	1.6	0.1	--	--	--	--	14.6	0.04	--
Unidentified	0.8	0.07	--	14.2	1.8	--	590.9	1.6	--
Less then ½ inch	338.0	31.2	--	299.9	30.1	--	11843.9	32.4	--
Totals	1084.1			763.3			36545.4		

SHELLFISH SPECIES	308.72 Weight (g)	308.72 % Total Weight	308.72 Number of Individuals				308, Stratum I (total amount recovered) Weight (g)	308, Stratum I (total amount recovered) % Total Weight	308, Stratum I (total amount recovered) Number of Individuals
M. mercenaria	--	--	--				72779.9	52.1	1212
C. virginica	--	--	--				5426.9	3.8	542
M. arenaria	--	--	--				9667.2	6.9	4833
E. directus	--	--	--				14.0	0.01	--
A. irradiens	--	--	--				29.0	0.02	15
S. solidissima	--	--	--				398.3	0.3	--
M. edulis	--	--	--				33.5	0.02	--
B. canaliculatum	--	--	--				232.3	0.2	--
C. fornicata	--	--	--				21.6	0.01	--
N. obsoletus	--	--	--				90.4	0.06	--
P. duplicatus	--	--	--				69.2	0.05	--
Unidentified	--	--	--				1758.9	1.2	--
Less than ¼ inch	4.4	100	--				49150.3	35.2	--
Totals	4.4						139671.5		

SHELLFISH SPECIES	308, Stratum II (total amount recovered) Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	29364.1	15.5	4894						
C. virginica	21311.8	11.5	213						
M. arenaria	27313.4	14.7	13656						
E. directus	8.2	0.004	--						
A. irradians	2814.4	1.5	1407						
S. solidissima	587.7	0.3	--						
M. edulis	15.0	0.008	--						
B. canaliculatum	322.1	0.2	--						
C. fornicata	67.6	0.03	--						
N. obsoletus	109.7	0.06	--						
P. duplicatus	45.3	0.02	--						
Unidentified	1633.4	0.09	--						
Less than ¼ inch	102237.0	55.0	--						
Totals	185829.7								

its superior durability rather than an originally greater frequency.

Particular considerations contributing to the differences between strata include Concentration 308.21 Stratum II, especially the features located therein, where Mya arenaria are well-represented. In Concentration 308.42, relative proportions of major species varied a great deal between strata. The estimated number of individuals of Mercenaria mercenaria decreased over 50%, and its relative proportion by weight decreased even more dramatically. On the other hand, estimated numbers of individuals and shell weights of Mya arenaria, Crassostrea virginica and Argopecten irradians increased markedly in Stratum II. These variations are attributable to the presence of numerous discrete shell lenses below the plowzone in a number of the excavation units (i.e., 107, 111, 112, 114) in this concentration. Although the depositional history of the site remains a challenging problem, there is a good possibility that some of these lenses (e.g. Excavation Unit 112, features 4 and 8; Excavation Unit 107 features 2, 3, 4 and 5) represent discrete depositional events based both on morphology of the feature and the estimated seasons of death of some of the constituent shells (see Chapter 12).

Shell weights for 19BN323 (Table 11.2) represent 100% of shell recovered during testing and excavation; no sampling procedure was usedat this site. In certain cases, where noted, totals include shell recovered via flotation: Concentration 323.14, Excavation Unit 11, Features 1 and 2; Concentration 323.22, Excavation Unit 7, Features 1 and 2 and Excavation Unit 12, Feature 1; Concentration 323.22, Stratum II, Excavation Unit 20, Features 1 and 2. For the site as a whole (including shovel tests and excavation units dug in 1979, 1980, and 1981) shell distribution was as follows: Mercenaria mercenaria 67.4% (tot. wgt.), 4922 est. ind.; Mya arenaria 6.3% (tot. wgt.), 922 est. ind.; Crassostrea virginica .5% (tot. wgt.), 22 est. ind.; Busycon canaliculatum .2% (tot. wgt.), and Spisula solidissima .1% (tot. wgt.). The remainder consisted of non-identifiable fragments. Similar patterns of species distributed were observed in Stratum I and Stratum II, though overall density was nearly 60% lower in Stratum II.

Mercenaria mercenaria was found in all concentrations, and in most loci constituted the major portion of remains by weight. Exceptions to this were noted in Feature 1 of Excavation Unit 11, Concentration 323.14, Stratum I in which Mya arenaria comprised 77.3% (33.7 g) by weight and 11 est. ind. of shell recovered. In this feature Mercenaria mercenaria contributed only 4.8% to total shell weight. A similar pattern was found in shell remains recovered via flotation from Excavation Unit 12, Feature 1 (Concentration 22, Stratum I). Finally, relatively high densities of Crassostrea virginica (a species whose shell decomposes easily and is therefore often underrepresented) were

TABLE 11.2 page 1

SHELLFISH SPECIES	19BW323 Total, Strata I and II: Weight (g)	19BW323 Total, Strata I and II: % Total Weight	19BW323 Total, Strata I and II: Number of Individuals	323.12 (excavation units only): Weight (g)	323.12 (excavation units only): % Total Weight	323.12 (excavation units only): Number of Individuals	323.13 (excavation units only): Weight (g)	323.13 (excavation units only): % Total Weight	323.13 (excavation units only): Number of Individuals
M. mercenaria	29533.7	67.4	4922	58.3	63.3	10	1.9	30.2	--
C. virginica	221.5	0.5	22	--	--	--	--	--	--
M. arenaria	2767.8	6.3	922	--	--	--	--	--	--
E. directus	0.4	0.001	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	57.8	0.1	--	--	--	--	--	--	--
M. edulis	9.7	0.02	--	--	--	--	--	--	--
B. canaliculatum	93.4	0.2	--	--	--	--	--	--	--
C. fornicata	42.7	0.1	--	--	--	--	--	--	--
N. obsoletus	49.9	0.1	--	--	--	--	--	--	--
P. duplicatus	51.8	0.1	--	--	--	--	--	--	--
Unidentified	159.8	0.4	--	11.7	12.7	--	--	--	--
Less than ¼ inch	10802.0	24.7	--	22.1	23.9	--	4.4	69.8	--
Totals	43790.5			92.1			6.3		

TABLE 11.2 page 2

SHELLFISH SPECIES	323.21 (excavation units only): Weight (g)	323.21 (excavation units only): % Total Weight	323.21 (excavation units only): Number of Individuals	323.22 (total amount recovered): Weight (g)	323.22 (total amount recovered): % Total Weight	323.22 (total amount recovered): Number of Individuals	323.22, EU 007, Feature 01: Weight (g)	323.22, EU 007, Feature 01: % Total Weight	323.22, EU 007, Feature 01: Number of Individuals
M. mercenaria	870.8	66.8	145	18187.2	67.1	3031	248.6	86.1	41
C. virginica	--	--	--	0.5	0.002	--	--	--	--
M. arenaria	13.2	1.0	4	1223.0	45.2	407	13.6	4.7	4
E. directus	--	--	--	0.4	4.5	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	3.2	0.2	--	53.0	0.2	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	39.9	0.1	--	--	--	--
C. fornicata	--	--	--	5.4	0.02	--	--	--	--
N. obsoletus	--	--	--	5.9	0.02	--	--	--	--
P. duplicatus	8.9	0.7	--	42.9	0.2	--	--	--	--
Unidentified	1.7	0.1	--	128.4	0.5	--	--	--	--
Less than ¼ inch	405.5	31.1	--	7388.4	27.3	--	26.5	9.2	--
Totals	1303.3			27025.0			288.7		

SHELLFISH SPECIES	323.14 (total amount recovered): Weight (g)	323.14 (total amount recovered): % Total Weight	323.14 (total amount recovered): Number of Individuals	323.14, EU 011, Feature 01: Weight (g)	323.14, EU 011, Feature 01: % Total Weight	323.14, EU 011, Feature 01: Number of Individuals	323.14, EU 011, Feature 02: Weight (g)	323.14, EU 011, Feature 02: % Total Weight	323.14, EU 011, Feature 02: Number of Individuals
M. mercenaria	43.5	39.9	7	2.1	4.8	--	6.9	79.3	1
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	33.7	30.9	11	33.7	77.3	11	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	4.4	4.0	--	3.5	8.0	--	0.9	10.3	--
Less than ¼ inch	27.5	25.2	--	4.3	9.9	--	0.9	10.3	--
Totals	109.1			43.6			7.8		

SHELLFISH SPECIES	323.22, EU 007, Feature 02: Weight (g)	323.22, EU 007, Feature 02: % Total Weight	323.22, EU 007, Feature 02: Number of Individuals	323.22, EU 012, Feature 01: Weight (g)	323.22, EU 012, Feature 01: % Total Weight	323.22, EU 012, Feature 01: Number of Individuals	323.22, Stratum II (total amount recovered): Weight (g)	323.22, Stratum II (total amount recovered): % Total Weight	323.22, Stratum II (total amount recovered): Number of Individuals
M. mercenaria	53.3	86.2	9	6.3	0.7	1	8585.4	66.9	1431
C. virginica	--	--	--	--	--	--	221.0	1.7	22
M. arenaria	--	--	--	643.9	67.3	214	7447.2	11.3	482
E. directus	--	--	--	0.4	0.04	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	1.6	0.01	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	42.9	0.3	--
C. fornicata	--	--	--	5.0	0.5	--	37.3	0.3	--
N. obsoletus	--	--	--	5.4	0.6	--	44.0	0.3	--
P. duplicatus	--	--	--	37.2	3.9	--	--	--	--
Unidentified	--	--	--	15.6	1.6	--	13.6	0.1	--
Less than ¼ inch	8.5	13.8	--	242.2	25.3	--	2430.8	18.9	--
Totals	61.8			956.0			12823.8		

TABLE 11.2 page 3

SHELLFISH SPECIES	323.22, Stratum II (whole shells only) Weight (g)	% Total Weight	Number of Individuals	323.22, EU 020, Stratum II Feature 01 Weight (g)	% Total Weight	Number of Individuals	323.22, EU 020, Stratum II Feature 02 Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	1411.8	76.4	24	694.7	44.4	116	257.3	75.6	43
C. virginica	--	--	--	193.2	12.4	--	--	--	--
M. arenaria	434.4	23.5	144	--	--	--	27.8	8.2	9
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	1.4	0.09	--	--	--	--
C. formicata	--	--	--	37.3	2.4	--	--	--	--
N. obsoletus	--	--	--	--	--	--	2.7	0.8	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--		1.5	0.4	--
Less than ¼ inch	--	--	--	636.1	40.7	--	50.9	15.0	--
Totals	1846.2			1562.7			340.2		

TABLE 11.2 page 4

SHELLFISH SPECIES	323, Stratum I (total amount recovered) Weight (g)	% Total Weight	Number of Individuals	323, Stratum II (total amount recovered) Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	20696.7	61.2	3449	8585.4	66.7	1430			
C. virginica	222.0	0.6	22	221.0	1.7	22			
M. arenaria	4062.1	12.0	2031	1447.2	11.2	723			
E. directus	0.4	0.001	--	--	--	--			
A. irradians	--	--	--	--	--	--			
S. solidissima	56.2	0.2	--	1.6	0.01	--			
M. edulis	9.7	0.02	--	--	--	--			
B. canaliculatum	50.5	0.1	--	42.9	0.3	--			
C. formicata	8.1	0.02	--	37.3	0.3	--			
N. obsoletus	5.9	0.01	--	44.0	0.3	--			
P. duplicatus	51.8	0.15	--	--	--	--			
Unidentified	146.2	0.4	--	13.6	0.1	--			
Less than ¼ inch	8524.7	25.2	--	2480.8	19.3	--			
Totals	33833.7			12873.8					

SHELLFISH SPECIES	323.23 (excavation units only) Weight (g)	% Total Weight	Number of Individuals	323.24 (excavation units only) Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	1330.9	72.2	222	61.7	53.0	10			
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	24.4	1.3	8	--	--	--			
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	9.7	8.3	--	--	--	--
B. canaliculatum	6.6	0.4	--	4.0	3.4	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	482.2	26.1	--	41.1	35.3	--	--	--	--
Totals	1844.1			116.5					

noted only in Feature 1 of Excavation Unit 20 Concentration 22, Stratum II.

Southern side of Salt Pond (Foldout Map E)

Mercenaria mercenaria and Mya arenaria were the only identifiable species recovered at 19BN273/275 (Table 11.3). All shell was found in Stratum I during field excavation. The vast majority of shell was limited to Concentration 273/275.31; Concentration 273/275.32 yielded only 19.2 grams of Mercenaria mercenaria. No shell had been recovered in flotation as of August 1982. 87.4% (2921.4 g) of total weight (3340.9 g) was Mercenaria; Mya arenaria constituted .2% (8.3 g) and mixed species made up the remaining 12.3% (411.2 g) of total weight. Sampling procedures were not used on this site; figures represent total quantities of shell collected and analyzed.

For 19BN274/339 (Table 11.4), species identified during field excavation and flotation included Mercenaria mercenaria, Crassostrea virginica, Mya arenaria, Spisula solidissima, Mytilus edulis, Busycon canaliculatum. All species were found in Concentration 274/339.12, Stratum I; other concentrations yielded Mercenaria mercenaria primarily. As of August 1982, flotation residue from Concentration 274/339.12, Stratum I had not been completely sorted, hence figures for that provenience are low in terms of actual quantities, though relative proportions may not be significantly affected. This concentration is the only one in this site for which samples were floated.

Shell weights on Table 11.5 do not represent 100% of shell recovered via excavation and flotation of features and column samples during testing and excavation on this site. Specifically, due to high shell density, shell was collected only via column samples only in Excavation Unit 22, Concentration 341.21; no other shell from this unit was retained.

Species distribution for the site overall was: Mercenaria mercenaria 47% of total weight (4242 est. ind.), Mya arenaria 3.8% of total weight (677 est. ind.), Spisula solidissima .5% of total weight, Crassostrea virginica .07% of total weight (3 est. ind.). Other species included Ensis durectus, Argopecten irradians, Busycon canaliculatum, Nassarius obsoletus and Polinices duplicatus,each constituting between .02 and .03% of total weight). Species distributions in Strata I and II followed a similar pattern with slightly greater overall densities in Stratum I.

Mercenaria mercenaria were found at all loci except Excavation Unit 17, Features 12 and 13 in Concentration 341.21, Stratum II, and constituted the major species by weight. Loci in which the proportion of Mya arenaria exceeded that of Mercenaria mercenaria by weight and estimated number of individuals were

TABLE 11.3 page 1

SHELLFISH SPECIES	198W273/275 Total			273/275.31			273/275.32		
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	2921.4	87.4	486.9	2274.3	84.4	379	19.2	100	3
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	8.3	0.2	4	8.3	0.3	4	--	--	--
B. diractus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	411.2	12.3	--	411.2	15.3	--	--	--	--
Totals	3340.9			2693.8			19.2		

TABLE 11.4 page 1

SHELLFISH SPECIES	1988274/339 Total			274/339.11			274/339.12		
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	6448.5	68.9	1074	1492.0	64.9	248	2456.2	58.4	409
C. virginica	2.5	0.02	--	--	--	--	2.5	0.05	--
M. arenaria	258.9	2.8	86	--	--	--	258.9	6.1	86
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	37.3	0.4	--	--	--	--	54.8	1.3	--
M. edulis	13.2	0.1	--	--	--	--	13.2	0.3	--
B. canaliculatum	212.4	2.3	--	21.3	0.9	--	5.1	0.1	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	87.3	0.9	--	--	--	--	77.4	1.8	--
Less than ½ inch	2168.3	23.4	--	783.4	34.1	--	1338.6	31.8	--
Totals	9228.4			2296.7			4206.7		

SHELLFISH SPECIES	274/339.13			274/339.22			274/339.31		
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	211.1	66.4	35	8.9	32.8	1	1773.0	93.9	295
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	67.7	21.2	--	11.0	40.5	--	113.2	6.1	--
Less than ½ inch	39.1	12.2	--	7.2	26.5	--	--	--	--
Totals	317.9			27.1			1886.2		

TABLE 11.5 page 1

SHELLFISH SPECIES	198H341 Total Strata I and II Weight (g)	198H341 Total Strata I and II % Total Weight	198H341 Total Strata I and II Number of individuals								
M. mercenaria	23452.3	47	4242								
C. virginica	36.1	.07	3								
M. arenaria	2033.5	3.8	677								
E. directus	11.5	0.02	--								
A. irradians	9.7	0.02	4								
S. solidissima	257.7	0.5	--								
M. edulis	--	--	--								
B. canaliculatum	10.4	0.02	--								
C. fornicata	--	--	--								
N. obsoletus	10.5	0.02	--								
P. duplicatus	8.4	0.01	--								
Unidentified	1337.3	2.5	--								
Less than ¼ inch	24959.7	46.1	--								
Totals	54127.1										

TABLE 11.5 page 2

SHELLFISH SPECIES	341.21, EU 017, Stratum II Feature 05, Flotation Weight (g)	% Total Weight	Number of individuals	341.21, EU 017, Stratum II Feature 06, Flotation Weight (g)	% Total Weight	Number of individuals	341.21, EU 017, Stratum II Feature 07, Flotation Weight (g)	% Total Weight	Number of individuals
M. mercenaria	11.5	85.2	2	16.8	60.0	2	47.2	73.5	10.6
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	1.2	8.9	--	3.8	13.6	-1	4.4	6.8	1
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	0.8	5.9	--	7.4	26.4	--	12.6	19.6	--
Totals	13.5			28.0			64.2		

SHELLFISH SPECIES	341.21 Weight (g)	341.21 % Total Weight	341.21 Number of individuals	341.21, Stratum II Weight (g)	341.21, Stratum II % Total Weight	341.21, Stratum II Number of individuals	341.21, EU 017, Stratum II Feature 02, Flotation Weight (g)	% Total Weight	Number of individuals
M. mercenaria	10806.5	58.2	1801	6488.3	58.6	1801	23.2	89.2	4
C. virginica	28.7	0.1	3	5.0	0.04	1	--	--	--
M. arenaria	878.4	4.7	292	725.5	6.6	241	0.4	1.5	--
E. directus	2.6	0.01	--	8.9	0.08	--	--	--	--
A. irradians	7.4	0.04	4	2.3	0.02	1	--	--	--
S. solidissima	155.2	0.8	--	100.2	0.9	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	0.4	0.004	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	6.8	0.04	--	2.0	0.02	--	--	--	--
P. duplicatus	6.7	0.04	--	1.7	0.01	--	--	--	--
Unidentified	214.8	1.2	--	135.5	1.2	--	--	--	--
Less than ¼ inch	6460.4	34.8	--	3600.1	32.5	--	2.4	9.2	--
Totals	18567.6			11069.9			26.0		

SHELLFISH SPECIES	341.21, EU 017, Stratum II Feature 08, Flotation Weight (g)	% Total Weight	Number of individuals	341.21, EU 017, Stratum II Feature 11, Flotation Weight (g)	% Total Weight	Number of individuals	341.21, EU 017, Stratum II Feature 12, Flotation Weight (g)	% Total Weight	Number of individuals
M. mercenaria	35.9	87.3	6	18.2	64.8	3	--	--	--
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	2.3	5.6	1	4.2	14.9	1	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	2.9	7.1	--	5.7	20.3	--	1.1	100	--
Totals	41.1			28.1			1.1		

TABLE 11.5 page 3

SHELLFISH SPECIES	341.27 Weight (g)	341.27 % Total Weight	341.27 Number of Individuals	341, Stratum I (total amount recovered) Weight (g)	341, Stratum I % Total Weight	341, Stratum I Number of Individuals	341, Stratum II (total amount recovered) Weight (g)	341, Stratum II % Total Weight	341, Stratum II Number of Individuals
M. mercenaria	44.7	100	7.4	12568.3	42.6	2094	10884.0	53.9	1814
C. virginica	--	--	--	28.7	0.09	3	7.4	0.03	1
M. arenaria	--	--	--	1071.4	3.6	535	962.1	4.8	481
E. directus	--	--	--	2.6	0.008	--	8.9	0.04	--
A. irradians	--	--	--	7.4	0.02	3	2.3	0.01	1
S. solidissima	--	--	--	156.9	0.5	--	100.2	0.5	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	10.0	0.03	--	0.4	0.001	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsolatus	--	--	--	8.1	0.02	--	0.3	0.001	--
P. duplicatus	--	--	--	6.7	0.02	--	1.7	0.008	--
Unidentified	--	--	--	508.3	1.7	--	829.0	4.1	--
Less than ¼ inch	--	--	--	16151.1	51.3	--	7390.0	36.6	--
Totals	44.7			29519.5			20186.3		

TABLE 11.5 page 4

SHELLFISH SPECIES	341.21, EU 017, Stratum II Feature 13, Flotation Weight (g)	% Total Weight	Number of Individuals	341.21, EU 017, Stratum II Feature 14, Flotation Weight (g)	% Total Weight	Number of Individuals	341.21, EU 017, Stratum II Feature 16, Flotation Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	--	--	--	12.6	66.3	2	45.3	67.9	7.5
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	3.4	48.6	1	2.8	14.7	1	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsolatus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	3.6	51.4	--	3.6	18.9	--	21.4	32.1	--
Totals	7.0			19.0			66.7		

SHELLFISH SPECIES	341.24, EU 021, Stratum II Feature 02, Flotation Weight (g)	% Total Weight	Number of Individuals	341.25 Weight (g)	% Total Weight	Number of Individuals	341.26 Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	34	22.6	5.6	58.2	100	9.7	22.7	100	3.7
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	71.9	47.7	23	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsolatus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	15.7	10.4	--	--	--	--	--	--	--
Less than ¼ inch	29	19.2	--	--	--	--	--	--	--
Totals	150.6			58.2			22.7		

SHELLFISH SPECIES	341.22 Weight (g)	% Total Weight	Number of Individuals	341.23 Weight (g)	% Total Weight	Number of Individuals	341.23 (1980 excavations) Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	15.1	100	2.5	5066.0	66.3	844	176.9	100	29
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	99.9	1.3	33	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	10.0	0.1	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsolatus	--	--	--	0.6	0.005	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	119.2	1.6	--	--	--	--
Less than ¼ inch	--	--	--	2346.4	30.7	--	--	--	--
Totals	15.1			7641.9			176.9		

TABLE 11.5 page 5

SHELLFISH SPECIES	341.23, EU 013 Feature 01, Flotation Weight (g)	% Total Weight	Number of Individuals	341.23, EU 013 Feature 02, Flotation Weight (g)	% Total Weight	Number of Individuals	341.23, EU 013 Feature 04, Flotation Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	8.6	56.9	1.4	13.5	89.4	2.2	20.8	88.5	3.4
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	3.2	21.2	1	--	--	--	--	--	--
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	3.3	21.8	--	1.6	10.6	--	2.7	11.5	--
Totals	15.1			15.1			23.5		

TABLE 11.5 page 6

SHELLFISH SPECIES	341.24 Weight (g)	% Total Weight	Number of Individuals	341.24 (1980 excavations) Weight (g)	% Total Weight	Number of Individuals	341.24, Stratum II Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	1621.1	55.4	270.2	372.1	100	62	684.8	34.7	114
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	93.1	3.2	31	--	--	--	147.7	7.5	49
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	1.7	0.06	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	1.3	0.04	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	174.3	5.9	--	--	--	--	684.4	34.7	--
Less than ¼ inch	1033.7	35.3	--	--	--	--	454.2	23	--
Totals	2925.2			372.1			1971.1		

SHELLFISH SPECIES	341.23, Stratum II Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	644.9	37.2	107.5						
C. virginica	2.4	0.1	--						
M. arenaria	88.9	5.1	29						
B. directus	--	--	--						
A. irradians	--	--	--						
S. solidissima	--	--	--						
M. edulis	--	--	--						
B. canaliculatum	--	--	--						
C. fornicata	--	--	--						
N. obsoletus	0.2	0.01	--						
P. duplicatus	--	--	--						
Unidentified	9.1	0.5	--						
Less than ¼ inch	989.3	57.0	--						
Totals	1734.8								

SHELLFISH SPECIES	341.24, EU 015, Stratum II Feature 01, Flotation Weight (g)	% Total Weight	Number of Individuals	341.24, EU 020, Stratum II Feature 01, Flotation Weight (g)	% Total Weight	Number of Individuals	341.24, EU 021, Stratum II Feature 01, Flotation Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	169.3	37.2	28	77.1	85.2	12.8	1.2	3.4	--
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	51.5	11.3	17	--	--	--	24.3	68.3	8
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	18.6	4.1	--	--	--	--	1.8	5.1	--
Less than ¼ inch	216.2	47.4	--	13.4	14.8	--	8.3	23.3	--
Totals	455.6			90.5			35.6		

Features 1 and 2 in Excavation Unit 21, Concentration 341.24, Stratum II. Most features were composed of either or both of the above species, as well as non-identifiable, small fragments.

Concentration 341.21 had the highest shell densities and species diversity. Column samples taken from Excavation Unit 22 were the major contributors to these totals. Remains of Crassostrea virginica were found only in Concentration 341.21, Strata I and II and in Concentration 341.23, Stratum II.

Northern Side of Salt Pond (Foldout Map F)

19BN288 is a large site, having several sizeable midden deposits. Mercenaria mercenaria was the most frequently occurring species by weight and estimated number of individuals (Table 11.6). Species distribution for the site overall was as follows: Mercenaria mercenaria 66.1% of total weight (12,224 est. ind.), Mya arenaria 1.0% of total weight (375 est. ind.), Argopecten irradians .02% total weight (10 est. ind.), Crassostrea virginica .06% total weight (8 est. ind.), Spisula solidissima .09% of total weight, Busycon canaliculatum .07% of total weight, Nassarius obsoletus and Polinices duplicatus each .01% of total weight and Crepidula fornicata .001% of total weight. The greatest diversity overall occurred in Stratum I. The entire collection from Stratum II consisted largely of Mya arenaria (22.0%) and Mercenaria mercenaria (14.2%).

Those concentrations having greatest species diversity and highest shell weights were Concentrations 288.33, Stratum I which included column samples and general level collections and Concentration 288.52, Stratum I which included shovel tests, column samples and general level collections. Interestingly, Feature 1 in Excavation Unit 9 of Concentration .52 yielded a fairly small quantity of shell, the majority of which (70.5% of total weight and 67 est. ind.) was that of Mya arenaria. This was a reversal of the usual trend (Mercenaria mercenaria generally predominated) noted for Stratum I and in collections made prior to 1981. Strata I and II were quite comparable in species diversity and distribution at of all loci. The concentrations with highest diversity of shell were Stratum I levels of Concentration 288.33, .45 and .57. A significant amount of the total shell collected on this site was from shovel test pits dug in 1979, 1980 and 1981.

All shell found at 19BN390 during survey and test excavation was collected and analyzed (Table 11.7). In addition to general level collections, features were removed for flotation. The weights listed in Table 11.7 represent shell quantities that were recovered by all of the above methods.

The overall species distribution at 19BN390 was: Mercenaria mercenaria 31.8% of total weight (706 est. ind.), Mya arenaria 12.1% of total weight (537 est. ind.), Crassostrea

TABLE 11.6 page 1

SHELLFISH SPECIES	1984 288 Total Strata I and II Weight (g)	1984 288 Total Strata I and II % Total Weight	1984 288 Total Strata I and II Number of Individuals	288.11 Weight (g)	288.11 % Total Weight	288.11 Number of Individuals	288.11, EUs 007 and 008 Column Sample Weight (g)	288.11, EUs 007 and 008 Column Sample % Total Weight	288.11, EUs 007 and 008 Column Sample Number of Individuals
M. mercenaria	72688.5	66.1	12114.7	1700.5	60.8	283.4	668.1	53.9	111.3
C. virginica	76.3	0.06	8	--	--	--	--	--	--
M. arenaria	1126.3	1.02	375	8.1	0.2	2	7.6	0.6	2
E. directus	0.6	0.001	--	--	--	--	--	--	--
A. irradians	19.0	0.02	10	--	--	--	--	--	--
D. solidissima	99.7	0.09	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	76.3	0.07	--	--	--	--	--	--	--
C. formicata	1.7	0.001	--	--	--	--	--	--	--
N. obsoletus	16.8	0.01	--	--	--	--	--	--	--
P. duplicatus	12.7	0.01	--	--	--	--	--	--	--
Unidentified	932.9	0.8	--	71.1	2.5	--	68.6	5.5	--
Less than ¼ inch	34880.7	31.7	--	1014.0	36.2	--	493.8	39.8	--
Totals	109931.6			2793.7			1238.1		

TABLE 11.6 page 2

SHELLFISH SPECIES	282.23 Weight (g)	282.23 % Total Weight	282.23 Number of Individuals	282.31 Weight (g)	282.31 % Total Weight	282.31 Number of Individuals	282.32 Weight (g)	282.32 % Total Weight	282.32 Number of Individuals
M. mercenaria	3514.2	52.8	585.7	3277.8	48.9	546.3	24.5	51.2	4.1
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	14.2	0.2	4	11.7	0.2	3	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
D. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	2.6	0.04	--	--	--	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	3.8	0.06	--	3.9	0.06	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	38.7	0.6	--	31.4	0.5	--	--	--	--
Less than ¼ inch	3081.6	46.3	--	3370.0	50.3	--	23.4	48.8	--
Totals	6655.1			6694.8			47.9		

SHELLFISH SPECIES	288.21 Weight (g)	288.21 % Total Weight	288.21 Number of Individuals	288.21, Stratum II Weight (g)	288.21, Stratum II % Total Weight	288.21, Stratum II Number of Individuals	288.22 Weight (g)	288.22 % Total Weight	288.22 Number of Individuals
M. mercenaria	175.9	59.5	29.3	41.1	8.3	6.8	1223.3	52.7	203.8
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	156.3	31.6	52	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
D. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	0.8	0.03	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	0.6	0.2	--	8.2	1.6	--	1.0	0.04	--
Less than ¼ inch	119.2	40.3	--	282.1	57.0	--	1095.5	47.2	--
Totals	295.7			494.6*			2320.6		

SHELLFISH SPECIES	288.33, EU 006 Column Sample Weight (g)	288.33, EU 006 Column Sample % Total Weight	288.33, EU 006 Column Sample Number of Individuals	288.34 Weight (g)	288.34 % Total Weight	288.34 Number of Individuals	288.41 Weight (g)	288.41 % Total Weight	288.41 Number of Individuals
M. mercenaria	10385.7	57.3	1730.9	26.6	71.5	4.4	513.9	72.1	85.6
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	120.3	0.7	40	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	2.0	0.01	1	--	--	--	--	--	--
D. solidissima	22.4	0.1	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	6.7	0.04	--	--	--	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
N. obsoletus	1.2	0.007	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	27.9	1.5	--	--	--	--	4.6	0.6	--
Less than ¼ inch	7565.0	41.7	--	10.6	28.5	--	193.8	27.2	--
Totals	18131.2			37.2			712.3		

NOTES

* total weight includes 6.9g of M. modiolus

TABLE 11.6 page 3

SHELLFISH SPECIES	288.41, EU 002 Column Sample Weight (g)	288.41, EU 002 Column Sample % Total Weight	288.41, EU 002 Column Sample Number of Individuals	288.42 Weight (g)	288.42 % Total Weight	288.42 Number of Individuals	288.42, EU 001 Column Sample Flotation Weight (g)	288.42, EU 001 Column Sample Flotation % Total Weight	288.42, EU 001 Column Sample Flotation Number of Individuals
M. mercenaria	174.0	100	29	3873.2	57.8	645.5	28.5	65.4	4.7
C. virginica	--	--	--	0.4	0.006	--	--	--	--
M. arenaria	--	--	--	12.7	0.2	4	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	2.6	0.04	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	7.7	0.1	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	88.1	1.3	--	--	--	--
Less than ¼ inch	--	--	--	2613.2	39.0	--	15.1	34.6	--
Totals	174.0			6697.9			43.6		

TABLE 11.6 page 4

SHELLFISH SPECIES	288.51 Column Sample Weight (g)	288.51 % Total Weight	288.51 Number of Individuals	288.51, EU 004 Column Sample Weight (g)	288.51, EU 004 % Total Weight	288.51, EU 004 Number of Individuals	288.52 Weight (g)	288.52 % Total Weight	288.52 Number of Individuals
M. mercenaria	2115.4	51.2	352.5	1385.9	61.8	230.9	2284.1	46.2	380.6
C. virginica	--	--	--	--	--	--	13.2	0.3	1
M. arenaria	2.8	0.07	1	--	--	--	588.2	11.9	196
E. directus	--	--	--	--	--	--	0.6	0.01	--
A. irradians	0.2	0.005	--	0.2	0.009	--	0.7	0.01	--
S. solidissima	1.3	0.03	--	1.3	0.06	--	57.9	1.2	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	4.9	0.09	--
C. formicata	--	--	--	--	--	--	--	--	--
M. obsoletus	0.3	0.007	--	--	--	--	1.5	0.03	--
P. duplicatus	12.7	0.3	--	--	--	--	--	--	--
Unidentified	75.6	1.8	--	45.3	2.0	--	28.0	0.6	--
Less than ¼ inch	1926.6	46.6	--	808.7	36.1	--	1946.5	39.8	--
Totals	4134.9			2241.4			4945.6		

SHELLFISH SPECIES	288.43 Weight (g)	288.43 % Total Weight	288.43 Number of Individuals	288.44 Weight (g)	288.44 % Total Weight	288.44 Number of Individuals	288.45 Weight (g)	288.45 % Total Weight	288.45 Number of Individuals
M. mercenaria	2631.1	60.1	438.5	135.4	65.1	22.5	4730.0	58.2	788.3
C. virginica	--	--	--	--	--	--	0.6	0.007	--
M. arenaria	8.3	0.2	2	--	--	--	31.1	0.4	10
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	6.9	0.08	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	6.3	0.1	--	--	--	--	10.2	0.1	--
C. formicata	--	--	--	--	--	--	--	--	--
M. obsoletus	0.3	0.007	--	--	--	--	4.3	0.05	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	7.6	0.2	--	--	--	--	125.9	1.5	--
Less than ¼ inch	1720.2	39.3	--	72.7	34.9	--	3215.5	39.6	--
Totals	4373.8			208.1			8124.5		

SHELLFISH SPECIES	288.52, EU 009 Column Sample Weight (g)	288.52, EU 009 Column Sample % Total Weight	288.52, EU 009 Column Sample Number of Individuals	288.52, EU 009 Feature 01 Weight (g)	288.52, EU 009 Feature 01 % Total Weight	288.52, EU 009 Feature 01 Number of Individuals	288.52, EU 009 Stratum II Column Sample Weight (g)	288.52, EU 009 Stratum II Column Sample % Total Weight	288.52, EU 009 Stratum II Column Sample Number of Individuals
M. mercenaria	186.5	60.7	31.1	83.8	29.3	13.9	59.7	53.7	9.9
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	5.3	1.7	1	201.8	70.5	67	--	--	--
E. directus	--	--	--	0.6	0.2	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	4.9	1.6	--	--	--	--	--	--	--
C. formicata	--	--	--	--	--	--	--	--	--
M. obsoletus	0.2	0.06	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	110.4	35.9	--	--	--	--	51.5	46.3	--
Totals	307.3			286.2			111.2		

TABLE 11.6 page 5

SHELLFISH SPECIES	288.53 Weight (g)	288.53 % Total Weight	288.53 Number of Individuals	288.54 Weight (g)	288.54 % Total Weight	288.54 Number of Individuals	288.55 Weight (g)	288.55 % Total Weight	288.55 Number of Individuals
M. mercenaria	1417.9	62.4	236.3	547.1	63.9	91.2	3774.0	62.6	62.9
C. virginica	0.5	0.02	--	--	--	--	2.0	0.03	--
M. arenaria	5.7	0.2	1	1.3	0.2	1	2.6	0.04	1
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	2.4	0.1	1	--	--	--	0.1	0.002	--
S. solidissima	6.6	0.3	--	--	--	--	2.0	0.03	--
M. edulis	--	--	--	--	--	--	--	--	--
B. cancellatum	--	--	--	--	--	--	4.3	0.07	--
C. fornicata	--	--	--	--	--	--	--	--	--
M. obsoletus	0.1	0.004	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	43.7	1.9	--	30.8	3.6	--	33.9	0.6	--
Less than ¼ inch	794.9	34.9	--	275.7	32.2		2205.9	36.6	--
Totals	2271.8			854.9			6024.8		

TABLE 11.6 page6

SHELLFISH SPECIES	288.58 Weight (g)	288.58 % Total Weight	288.58 Number of Individuals	288.61 Weight (g)	288.61 % Total Weight	288.61 Number of Individuals	288.62 Weight (g)	288.62 % Total Weight	288.62 Number of Individuals
M. mercenaria	121.1	71.1	20.2	42.0	54.4	7.0	47.3	57.1	7.8
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	--	--	--
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. cancellatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	0.7	0.9	--	9.5	11.5	--
Less than ¼ inch	49.1	28.9	--	34.5	44.7	--	26.0	31.4	--
Totals	170.2			77.2			82.8		

SHELLFISH SPECIES	288.56 Weight (g)	288.56 % Total Weight	288.56 Number of Individuals	288.57 Weight (g)	288.57 % Total Weight	288.57 Number of Individuals	288.57, EU 013 Column Sample Weight (g)	288.57, EU 013 Column Sample % Total Weight	288.57, EU 013 Column Sample Number of Individuals
M. mercenaria	697.6	56.5	116.2	5211.9	66.5	868.6	75.5	64.6	12.6
C. virginica	--	--	--	38.0	0.5	4	--	--	--
M. arenaria	--	--	--	43.8	0.6	14	--	--	--
B. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	11.4	0.1	5	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. cancellatum	--	--	--	5.0	0.06	--	2.5	2.1	--
C. fornicata	--	--	--	1.7	0.02	--	--	--	--
M. obsoletus	--	--	--	0.6	0.008	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	10.0	0.8	--	26.1	0.3	--	2.7	2.3	--
Less than ¼ inch	526.6	42.7	--	2437.6	31.1	--	36.1	30.9	--
Totals	1234.2			7836.1			116.8		

SHELLFISH SPECIES	288.63 Weight (g)	288.63 % Total Weight	288.63 Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	288, Stratum I (total amount recovered) Weight (g)	288, Stratum I (total amount recovered) % Total Weight	288, Stratum I (total amount recovered) Number of Individuals
M. mercenaria	6.4	42.9	1.0				48300.3	56.8	8050.0
C. virginica	--	--	--				54.7	0.06	5
M. arenaria	--	--	--				870.6	1.0	290
B. directus	--	--	--				0.6	0.001	--
A. irradians	--	--	--				16.8	0.02	8
S. solidissima	--	--	--				99.7	0.1	--
M. edulis	--	--	--				--	--	--
B. cancellatum	--	--	--				47.7	0.06	--
C. fornicata	--	--	--				1.7	0.002	--
M. obsoletus	--	--	--				16.8	0.02	--
P. duplicatus	--	--	--				12.7	0.01	--
Unidentified	--	--	--				904.9	1.1	--
Less than ¼ inch	8.5	57.1	--				34704.8	40.8	--
Totals	14.9						85031.3		

288, Stratum II

SHELLFISH SPECIES	(total amount recovered) Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	100.8	14.2	16.8						
C. virginica	--	--	--						
M. cremaria	156.3	22.0	52						
E. directus	--	--	--						
A. irradians	--	--	--						
S. solidissima	--	--	--						
M. edulis	--	--	--						
B. camilliculatum	--	--	--						
C. formicata	--	--	--						
N. obsoletus	--	--	--						
P. duplicatus	--	--	--						
Unidentified	59.7	8.4	--						
Less than ½ inch	393.3	55.4	--						
Totals	710.1								

virginica 16.9% of total weight (225 est. ind.), Crepidula fornicata 1.3% of total weight, Spisula solidissima .8% of total weight, Polinices duplicatus .5% of total weight, Buscyon canaliculatum .4% of total weight, Argopecten irradians .2% of total weight (11 est. ind.) and Nassarius obsoletus .1% of total weight. In terms of the above distribution, this site presents some interesting contrasts with other sites on the Outer Cape. Though Mercenaria mercenaria is the most frequent species by weight, its density relative to other species, i.e. Mya arenaria and Crassostrea virginica, is not as great here as on other sites. Indeed, oyster shells constitute a significant proportion of these remains. Furthermore, Crassostrea virginica is the predominant species by weight in Stratum I, overall, followed by Mercenaria mercenaria and Mya arenaria. Mya arenaria predominates among Stratum II loci, in terms of estimated numbers of individuals, though in terms of weight, Mercenaria mercenaria is densest followed by Mya arenaria and Crassostrea virginica.

Closer examination reveals some of the factors contributing to these distributions. Concentration 390.33, Stratum I contains nearly equal proportions (by weight) of Mercenaria mercenaria (44.2%) and Crassostrea virginica (41.8%). Mya arenaria make up a smaller (7.9%) proportion of shell weight. Stratum I levels of concentration 390.34 also have a high proportion of C. virginica by weight (46%) and estimated number of individuals (55). Weight of Mercenaria mercenaria comprises 18.8% of the total weight (37 est. ind.), while Mya arenaria represents only .8% of total weight (3 est. ind.).

Similarly, examination of the Stratum II levels of some concentrations indicates that large quantites of Mya arenaria were present in certain discrete loci. In general, in Concentration 390.33, Stratum II, the highest frequency by weight is constituted by Mercenaria mercenaria, followed by Mya arenaria and Crassostrea virginica, respectively. However, Feature 2 in Excavation Unit 9 of the same concentration and stratum is predominated by Mya arenaria, which is followed by Mercenaria mercenaria and Crassostrea virginica in nearly equal proportions. Results from flotation samples alone of that feature reveal a similar distribution.

Because the above-mentioned concentrations had very high shell densities and diversities, total site tabulations were strongly influenced by their contributions.

The relatively high quantities of Crassostrea virginica recovered in many concentrations contrasts with the general paucity of these shell remains at other sites. The factors affecting this distribution are unknown. Possible areas for further inquiry include the local availability of this species, temporal and stratigraphic context of the oyster shell deposits.

TABLE 11.7 page 1

SHELLFISH SPECIES	198N390 Total Strata I and II Weight (g)	198N390 Total Strata I and II % Total Weight	198N390 Total Strata I and II Number of Individuals	390.21 Weight (g)	390.21 % Total Weight	390.21 Number of Individuals	390.22 Weight (g)	390.22 % Total Weight	390.22 Number of Individuals
M. mercenaria	4241.4	31.8	706	21.6	61.9	3.6	36.7	75.9	6
C. virginica	2255.2	16.9	225	--	--	--	--	--	--
M. arenaria	1612.1	12.1	537	--	--	--	--	--	--
E. directus	0.6	0.004	--	--	--	--	--	--	--
A. irradians	23.8	0.2	11	--	--	--	--	--	--
S. solidissima	103.2	0.8	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	52.0	0.4	--	--	--	--	--	--	--
C. fornicata	44.4	0.3	--	--	--	--	--	--	--
N. obsoletus	18.5	0.1	--	--	--	--	--	--	--
F. duplicatus	70.8	0.5	--	--	--	--	--	--	--
Unidentified	243.9	1.8	--	--	--	--	3.0	6.2	--
Less than ¼ inch	4665.4	34.9	--	13.3	38.1	--	8.6	17.8	--
Totals	13331.3			34.9			48.3		

TABLE 11.7 page 2

SHELLFISH SPECIES	390.33 Weight (g)	390.33 % Total Weight	390.33 Number of Individuals	390.33, Stratum II Weight (g)	390.33, Stratum II % Total Weight	390.33, Stratum II Number of Individuals	390.33, EU 0009 Feature 01, Flotation Weight (g)	390.33, EU 0009 Feature 01, Flotation % Total Weight	390.33, EU 0009 Feature 01, Flotation Number of Individuals
M. mercenaria	813.8	44.2	135	3074.3	30.7	512	891.7	31.1	148
C. virginica	770.4	41.8	77	897.5	8.9	89	95.1	3.1	9
M. arenaria	147.1	7.9	49	1449.0	14.5	483	520.3	18.1	173
E. directus	--	--	--	0.6	0.006	--	--	--	--
A. irradians	--	--	--	23.8	0.2	11	11.1	0.4	5
S. solidissima	10.2	0.5	--	88.7	0.9	--	69.2	2.4	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	50.9	0.5	--	1.5	0.05	--
C. fornicata	--	--	--	17.3	0.2	--	3.7	0.1	--
N. obsoletus	0.1	0.005	--	18.4	0.2	--	3.4	0.1	--
F. duplicatus	3.6	0.2	--	67.2	0.7	--	--	--	--
Unidentified	15.4	0.8	--	214.0	2.1	--	108.4	3.8	--
Less than ¼ inch	82.1	4.4	--	4112.3	41.1	--	1166.3	40.6	--
Totals	1842.7			10014.0			2870.7		

SHELLFISH SPECIES	390.23 Weight (g)	390.23 % Total Weight	390.23 Number of Individuals	390.31 Weight (g)	390.31 % Total Weight	390.31 Number of Individuals	390.32 Weight (g)	390.32 % Total Weight	390.32 Number of Individuals
M. mercenaria	28.7	48.6	4	15.8	47.7	2	--	--	--
C. virginica	1.0	1.7	--	--	--	--	--	--	--
M. arenaria	6.6	11.2	2	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	4.3	7.3	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
N. obsoletus	--	--	--	--	--	--	--	--	--
F. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	2.9	8.8	--	--	--	--
Less than ¼ inch	18.5	31.3	--	14.4	43.5	--	1.6	100	--
Totals	59.1			33.1			1.6		

SHELLFISH SPECIES	390.33, EU 0009 Feature 02 Weight (g)	390.33, EU 0009 Feature 02 % Total Weight	390.33, EU 0009 Feature 02 Number of Individuals	390.33, EU 0009 Feature 02, Flotation Weight (g)	390.33, EU 0009 Feature 02, Flotation % Total Weight	390.33, EU 0009 Feature 02, Flotation Number of Individuals	390.34 Weight (g)	390.34 % Total Weight	390.34 Number of Individuals
M. mercenaria	236.61	11.1	39	114.1	9.5	19	224.9	18.8	37
C. virginica	229.0	10.8	22	91.8	7.6	9	551.6	46.0	55
M. arenaria	381.5	17.9	127	273.9	22.8	91	9.4	0.8	3
E. directus	0.2	0.01	--	0.2	0.02	--	--	--	--
A. irradians	7.6	0.4	3	3.5	0.3	1	--	--	--
S. solidissima	7.5	0.3	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	28.6	1.3	--	12.7	1.1	--	1.1	0.09	--
C. fornicata	11.8	0.6	--	10.4	0.9	--	27.1	2.3	--
N. obsoletus	7.5	0.3	--	0.4	0.03	--	--	--	--
F. duplicatus	62.1	2.9	--	--	--	--	--	--	--
Unidentified	14.2	0.7	--	14.2	1.2	--	7.3	0.6	--
Less than ¼ inch	1136.3	53.5	--	681.1	5.1	--	377.1	31.5	--
Totals	2122.9			1202.3			1198.5		

TABLE 11.7 page 3

SHELLFISH SPECIES	390.34, Stratum II			390.35			390.36		
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	2.2	84.6	--	5.2	20.2	1	4.5	51.1	--
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	--	--	--	1.3	5.1	--	--	--	--
Less than ¼ inch	0.4	15.4	--	19.2	74.7	--	4.3	48.9	--
Totals	2.6			25.7			8.8		

TABLE 11.7 page 4

SHELLFISH SPECIES	390, Stratum II (total amount recovered)								
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	3081.1	30.7	513						
C. virginica	898.4	8.9	89						
M. arenaria	1449.1	14.4	724						
E. directus	0.6	0.005	--						
A. irradians	23.8	0.2	11						
S. solidissima	88.7	0.9	--						
M. edulis	--	--	--						
B. canaliculatum	50.9	0.5	--						
C. fornicata	17.3	0.2	--						
M. obsoletus	18.4	0.2	--						
P. duplicatus	67.2	0.7	--						
Unidentified	214.0	2.1	--						
Less than ¼ inch	4112.7	41.0	--						
Totals	10022.2								

SHELLFISH SPECIES	390.37			390.37, Stratum II			390, Stratum I (total amount recovered)		
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	9.1	17.3	1	4.6	48.9	--	1160.3	26.0	193
C. virginica	33.8	64.2	3	0.9	9.5	--	1356.8	30.4	135
M. arenaria	--	--	--	--	--	--	163.1	3.6	81
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	17.5	0.4	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	1.1	0.02	--
C. fornicata	--	--	--	--	--	--	27.1	0.6	--
M. obsoletus	--	--	--	--	--	--	0.1	0.002	--
P. duplicatus	--	--	--	--	--	--	3.6	0.08	--
Unidentified	--	--	--	--	--	--	29.9	0.7	--
Less than ¼ inch	9.7	18.4	--	3.9	41.5	--	534.8	12.0	--
Totals	52.6			9.4			4454.6		

Northern Side of Nauset Marsh (Foldout Map G)

Shell weights listed represent 100% of material collected in the course of excavation in concentrations at 19BN333/6/7 (Table 11.8). No shell was recovered via flotation. Mercenaria mercenaria was the most frequently occurring species overall, comprising 62.2% (4807.9 g) of total weight and 1602 estimated individuals. Mercenaria mercenaria predominated in each individual concentration as well. The proportions represented by other identified species, Mya arenaria, Crassostrea virginica, Busycon canaliculatum and Nassarius obsoletus was negligible both overall and in individual concentrations. Non-identifiable fragments constituted 37.2% of total weight.

Truro Wetlands (Foldout Map J)

Small amounts of shell were recovered at 19BN355 (table 11.9). Only 17.6 grams of shell, the majority of which were identified as Spisula solidissima, were collected. This figure represents all of the excavated shell; no sampling was undertaken. No shell was recovered in flotation. Overall species distribution was as follows: Mercenaria mercenaria 9.1% of total weight (1.6 g), Spisula solidissima 23.3% (4.1 g) and non-identifiable fragments 69.3% (12.2 g).

High Head (Foldout Map K)

A very small quantity of shell (26.1 g) was recovered from 19BN282/3/4 (Table 11.10); Mercenaria mercenaria was the most prevalent species. All shells collected were from stratum I levels in Concentrations 282.12, .23 and .24. No shell was recovered via flotation. Weights recorded represent 100% of all shell collected during survey and excavation.

Provincelands (Foldout Map M)

Situated in a blowout area of the active dune field in the Provincelands, 19BN410 was located and examined during 1981. Excavation units on site 410 were sampled by constant weight samples of 1000g from each level. This material was screened, sorted and catalogued in the laboratory.

Contrary to many other sites on the outer Cape, Mercenaria mercenaria was not the most frequent species (Table 11.11). Crassostrea virginica was the most highly represented species in terms of both weight, 31.4% of total weight (3916.6g) and estimated number of individuals (392). Mya arenaria followed with 6.2% (775.5g), 258 est. ind.; 716.5 g (5.7% by wgt.) of Mercenaria mercenaria were tabulated, though in terms of estimated numbers of individuals (119), this species was

TABLE 11.8 page 1

SHELLFISH SPECIES	1980 333/6/7 Total Weight (g)	1980 333/6/7 Total % Total Weight	1980 333/6/7 Total Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	4807.9	62.2	1602						
C. virginica	4.1	0.05	1						
M. arenaria	39.1	0.5	20						
E. directus	--	--	--						
A. irradians	--	--	--						
S. solidissima	--	--	--						
M. edulis	--	--	--						
B. canaliculatum	2.9	0.03	--						
C. fornicate	--	--	--						
M. obsoletus	0.1	0.001	--						
P. duplicatus	--	--	--						
Unidentified	477.3	6.2	--						
Less than ¼ inch	2398.3	31.0	--						
Totals	7729.7								

TABLE 11.9 page 1

SHELLFISH SPECIES	1980 355 Total Weight (g)	1980 355 Total % Total Weight	1980 355 Total Number of Individuals	355.11 Weight (g)	355.11 % Total Weight	355.11 Number of Individuals	355.12 Weight (g)	355.12 % Total Weight	355.12 Number of Individuals
M. mercenaria	1.6	9.1	--	--	--	--	1.6	27.1	--
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	4.1	23.3	--	--	--	--	4.1	69.5	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	5.8	32.9	--	5.8	52.7	--	--	--	--
Less than ¼ inch	6.4	36.4	--	5.2	47.3	--	0.2	3.4	--
Totals	17.6			11.0			5.9		

SHELLFISH SPECIES	333/6/7.11 Weight (g)	333/6/7.11 % Total Weight	333/6/7.11 Number of Individuals	333/6/7.12 Weight (g)	333/6/7.12 % Total Weight	333/6/7.12 Number of Individuals	333/6/7.14 Weight (g)	333/6/7.14 % Total Weight	333/6/7.14 Number of Individuals
M. mercenaria	3009	64.4	501	1379.3	59.1	230	419.6	57.9	70
C. virginica	--	--	--	4.1	0.2	1	--	--	--
M. arenaria	13.5	0.3	4	25.4	1.1	8	0.2	0.03	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	--	--	--	--	--	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	1.1	0.02	--	1.8	0.07	--	--	--	--
C. fornicate	--	--	--	--	--	--	--	--	--
M. obsoletus	0.1	0.002	--	--	--	--	--	--	--
P. duplicatus	--	--	--	--	--	--	--	--	--
Unidentified	177.7	3.8	--	213.2	9.1	--	86.4	11.9	--
Less than ¼ inch	1468.8	31.4	--	710.7	30.4	--	218.8	30.2	--
Totals	4670.2			2334.5			725.0		

SHELLFISH SPECIES	355.21 Weight (g)	355.21 % Total Weight	355.21 Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	--	--	--						
C. virginica	--	--	--						
M. arenaria	--	--	--						
E. directus	--	--	--						
A. irradians	--	--	--						
S. solidissima	--	--	--						
M. edulis	--	--	--						
B. canaliculatum	--	--	--						
C. fornicate	--	--	--						
M. obsoletus	--	--	--						
P. duplicatus	--	--	--						
Unidentified	--	--	--						
Less than ¼ inch	1.0	100	--						
Totals	1.0								

TABLE 11.10 page 1

SHELLFISH SPECIES	1984 282/283/284 Total Weight (g)	1984 282/283/284 Total % Total Weight	1984 282/283/284 Total Number of Individuals	282/283/284.12 Weight (g)	282/283/284.12 % Total Weight	282/283/284.12 Number of Individuals	282/283/284.23 Weight (g)	282/283/284.23 % Total Weight	282/283/284.23 Number of Individuals
M. mercenaria	12.1	46.3	2	8.2	39.0	1	3.3	97.0	--
C. virginica	--	--	--	--	--	--	--	--	--
M. arenaria	--	--	--	--	--	--	--	--	--
E. directus	--	--	--	--	--	--	--	--	--
A. irradians	--	--	--	--	--	--	--	--	--
S. solidissima	2.8	10.7	--	2.8	13.3	--	--	--	--
M. edulis	--	--	--	--	--	--	--	--	--
B. canaliculatum	--	--	--	--	--	--	--	--	--
C. fornicata	--	--	--	--	--	--	--	--	--
M. obsoletus	--	--	--	--	--	--	--	--	--
P. duplicatus	3.6	13.7	--	3.6	17.1	--	--	--	--
Unidentified	--	--	--	--	--	--	--	--	--
Less than ¼ inch	7.6	29.1	--	6.4	30.4	--	0.1	3.0	--
Totals	26.1			21.0			3.4		

SHELLFISH SPECIES	282/283/284.24 Weight (g)	282/283/284.24 % Total Weight	282/283/284.24 Number of Individuals	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	0.6	35.2	--						
C. virginica	--	--	--						
M. arenaria	--	--	--						
E. directus	--	--	--						
A. irradians	--	--	--						
S. solidissima	--	--	--						
M. edulis	--	--	--						
B. canaliculatum	--	--	--						
C. fornicata	--	--	--						
M. obsoletus	--	--	--						
P. duplicatus	--	--	--						
Unidentified	--	--	--						
Less than ¼ inch	1.1	64.7	--						
Totals	1.7								

TABLE 11.11 page 1

SHELLFISH SPECIES	1984 410 Total								
	Weight (g)	% Total Weight	Number of Individuals	Weight (g)	% Total Weight	Number of individuals	Weight (g)	% Total Weight	Number of Individuals
M. mercenaria	716.5	5.7	119						
C. virginica	3919.6	31.4	--						
M. arenaria	755.5	6.2	258						
E. directus	4.7	0.04	--						
A. irradians	358.0	2.9	179						
S. solidissima	679.0	5.5	--						
M. edulis	--	--	--						
B. canaliculatum	--	--	--						
C. formicata	--	--	--						
M. obsoletus	0.1	0.00	--						
P. duplicatus	12.4	0.1	--						
Unidentified	49.2	0.4	--						
Less than ½ inch	5946.8	47.7	--						
Totals	12461.8								

exceeded by Argopecten irradians (358 g, 2.9% by wgt. and 179 est. ind.). Finally, 679 g (5.5% by wgt.) of Spisula solidissima were noted. Other species present included Ensis directus, Nassarius obsoletus, and Polinices duplicatus. 49.2 g of non-identifiable fragments were counted. Shells from this site were extremely weathered.

Concluding Remarks

On the sites discussed, varying quantities of locally available marine bivalves and gastropods were found. Species represented on these sites, if not available in the immediate vicinity, can be found today within a few kilometers. In terms of overall density (weight and estimated numbers of individuals), four species, Mercenaria mercenaria, Mya arenaria, Crassostrea virginica and Argopecten irradians, predominate in the collections. Their relative proportions in total shell weight vary among sites and among intra-site loci (e.g., concentrations, strata and features). All of the above species (except A. irradians) are intertidal and have relatively broad temperature/salinity tolerances (Whitlach 1982).

Although these species (and other gastropod species discussed earlier) enjoy wide distribution, their average quantities per site are not high enough to suggest that they were dietary staples. Many archeologists (e.g., Bailey 1978; Claassen 1982; Sanger 1981) and ethnographers (e.g. Bigalke 1973; Meehan 1977a and 1977b) have suggested that the year-round availability and ease of collection make shellfish important nutritional supplements, though their roles as dietary staples are more limited and depend on the availability of other foods. In addition to their use as food, mollusk shells provided temper for ceramics.

The relationship of shellfish species density and diversity to overall subsistence and settlement patterns is undoubtedly complex. A number of considerations limit the kinds of inferences that can be drawn from the data described here. These include the fact that weight and estimated number of individuals may not be the most sensitive measure of the actual dietary role played by shellfish. Controlled studies of caloric and nutritional values of the important species must be conducted and then used to interpret the meaning-- in terms of diet and nutrition-- of these foods in aboriginal lifeways (e.g. Parmalee and Klippel 1975). Secondly, shellfish are only one element in the diet; remains of many other foods (e.g., mammal, bird, fish, fruit, vegetable and nuts) have been found on these sites. These data (see Chapter 10), in conjunction with those generated by shellfish analysis, will provide a rudimentary notion of the subsistence patterns of the prehistoric occupants of the sites.

Despite these cautionary observations, data in this chapter, coupled with supporting ethnographic and ethnohistorical information, allow a number of tentative conclusions. Ethnographic reports of modern hunter-gatherer and/or horticulturalist coastal populations have indicated that intertidal shellfish are collected in limited quantities during all seasons; there is greater reliance on this resource when other products are scarce (Bigalke 1973; Meehan 1977a, 1977b). Meehan (1977b) has observed that shellfish were a small but dependable source of fresh protein for the Anbara, a population residing in coastal northern Australia. Their collection was an important component of the foraging strategy, the other part of which included hunting and fishing (Meehan 1977b).

An analogous situation may be proposed regarding the prehistoric population of the Outer Cape. Shell middens are widely distributed on archeological sites in this region, and are quite thick in some cases. Based on growth line analyses of Mercenaria mercenaria (see Chapter 12), collection could have taken place during all seasons at most sites where middens were found, although deposits representing single depositional episodes and a focusing of collection during some months were observed (see Chapter 16).

Ethnohistorical data on this subject are sparse. Marten (1970:8), in her review of seventeenth century literature pertaining to the Wampanoags, observed (citing William Wood, New England's Prospect) that clams were dug during all seasons and were relied on more heavily when other food sources dwindled (1970:8). In his Key to the Language of America, Roger Williams noted, with respect to clams, "this is a sweet kind of shelfish, which all Indians generally over the Countrey, Winter and Summer delight in; and at low water the women dig for them..." (1866:182). Thus, to the European eye, shellfish (i.e., clams, scallops, mussels and oysters) were a densely distributed and readily available form of food (see also Bradford (1912:16).

Ethnohistorical, archeological and ethnographic data contribute to a reconstruction of aboriginal subsistence in which shellfish play an important role, though not as a predominant resource. Shellfish are "low-cost" sources of nutrients, in comparison with other kinds of animal protein (see Perlman 1980; Yesner 1980). They were probably collected during all seasons but should be viewed as dietary supplements, rather than mainstays. During lean periods when other foods were not available, however, shellfish probably constituted a reliable and relatively greater proportion of the total diet.

In terms of settlement systems, this interpretation supports Bailey's (1978:39) suggestion that "...shell gathering was only one of several diverse exploitation activities..." undertaken from some kinds of coastal locations. Despite their high visibility and the common corresponding inference of

quantitative importance in diet shellfish remains represent a resource that may have constituted only a small fraction of the total diet. This possibility becomes more tenable when we consider the larger ecological community of which the shellfish found on these sites are components. The sandy and muddy intertidal zones where many species of shellfish flourish on the Outer Cape are often parts of larger estuaries (e.g., Nauset Bay). Estuaries are complex ecosystems that link fresh water and marine communities (Carriker 1967; Pritchard 1967; Whittaker 1975); they are areas of high marine productivity and associated diversity and density of terrestrial and aquatic plant and animal species. This results in variety of resources available for exploitation by humans. The floral and faunal analyses discussed in Chapter 10 provide ample evidence of the broad subsistence base associated with these coastal habitation sites.

The presence of shellfish may have facilitated settlement in a particular area, inasmuch as they are dietary supplements and may buffer the effects of resource scarcity during lean periods. As we have seen, however, a number of site collections contained only minor amounts of shell: barely a few meals' worth. Other sites contained extensive middens and/or a number of middens at various loci. Overall species diversity on the latter sites was relatively high; most of the major inter-tidal bivalves (with notable exceptions, i.e. Mytlius edulis) were represented. Due to differences in preservation, it is possible that some species (e.g., Crassostrea virginica and Mytilus edulis) are under-represented, resulting in relative inflation of values for other species.

Shellfish data alone will not inform us of the relative importance of shellfish in the aboriginal diet. In order to make sense of the variation in species distribution between and within sites, corroborating information on other organic remains is necessary. However, the information presented in the this chapter points to some interesting problems regarding settlement and subsistence for example, do functional and/or chronological differences between concentrations correlate with differences in the density or diversity of shell remains?

Shellfish remains are keys to other classes of information. Careful investigation of shell midden stratigraphy and morphology may provide clues to the depositional history of sites. Season(s) of occupation may be inferred by examination of shell growth indicators (i.e., internal growth lines, see Chapter 12). Finally, the midden itself constitutes a favorable preservation environment in which many organic remains, otherwise lost, are preserved and therefore accessible for more extensive analyses. The work carried out in the context of this project and reported in this and other chapters is a realization of some of the rich potential for research offered by coastal midden sites.

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CHAPTER 12

Analysis of Shellfish Remains for Seasonality Information

Mary E. Hancock

Introduction

Shell remains of the intertidal bivalve Mercenaria mercenaria, known locally as quahog, from eight prehistoric sites were analyzed to determine the seasons of death represented in the collections. A longitudinal sample of modern quahogs, obtained locally at monthly intervals for one year, provided a reference for identification and measurement of cyclic growth indicators. Monthly indices for internal growth lines were constructed via analysis of modern shells.

An extensive body of literature on the subject of Mercenaria's internal shell growth patterns has developed in the past two decades (Barker 1964, 1970; Berry 1971; Claassen 1982; Clark 1974, 1979; Cross 1979; Conliffe and Kennish 1974; Gordon and Carriker 1978; Kennedy et al 1969; Kennish 1980; Lutz and Rhoads 1980; MacClintock and Pannella 1969; Pannella 1975; Pannella and MacClintock 1968; Rhoads and Lutz 1980; Rhoads and Pannella 1970; Rosenberg and Runcorn 1975; Shaw 1978; Wilbur 1972). Review of this literature provided the basic theoretical and methodological framework for the formulation of this study. Principles pertaining to the nature of shell growth, known morphological indices as well as practical information regarding sample preparation and analysis, may be found in many of these sources. The study of modern growth included herein represents the application, on a local scale, of certain generally accepted theories. Consequently, certain facts about shell growth have been accepted as given; for example, the presence of circadian lunar-monthly and annual growth lines is not questioned; the present thrust of questioning addresses the timing of annual lines within the geographic context of the study area and also the practical problems of distinguishing different kinds of lines in a given shell. In organizing the research in this way, I have sought primarily to provide a reliable reference for the estimation of season of death of fossil specimens from archeological sites. The larger objective is to be found in the use of these data coupled with those derived from analysis of

other seasonality indicators for determination of the existence of seasonal patterns of prehistoric site utilization.

In the next section, results of analysis of the growth cycle of modern quahogs are presented and their application to archeological seasonality determination discussed. Next, methods for the estimation of time of death are outlined and applied to the analysis of the archeological shells mentioned above Finally, results of this investigation and implications for assessment of site seasonality are presented.

Materials and Methods: The Modern Collection

Mercenaria mercenaria are infaunal filter-feeders and are found inter- and sub-tidally in sandy areas (Belding 1931, Turner 1953). Their present range extends in the United States from the Gulf of Mexico to Cape Cod, although isolated populations are found in Maine and the Gulf of St. Lawrence, where local conditions permit (Ansell 1968). Temperature is the major limiting factor governing distribution; growth and reproduction are inhibited at temperatures below 9 degrees C and above 20 degrees C (Kennedy and Mihursky 1971; Loosanoff et al. 1951; Newall & Bayne 1973). In northern populations a generally accelerated growth rate has been observed during periods of the year when water temperatures and available food are both increased; these factors contribute to an increased metabolic rate relative to periods of sub-optimum conditions for either or both of these factors. In biological terms, the annual metabolic cycle is divisible into an active and a slow phase. The duration and seasonal associations of each phase vary with the animal's life stage. Juvenile and mature individuals exhibit proportionally longer active growth phases during the annual cycle than do older, senescent individuals.

Growth cyclicity is reflected in shell structure and morphology. A number of authors have observed that growth structures are particularly clear in the shells of M. mercenaria as opposed to other species (e.g., Mya arenaria, soft shell clam). The valves are constructed of a series of calcareous layers: inner, middle, and outer as shown in Figures 12.1 and 12.2 (Kennish 1980; Clark 1979, 1980; Kennedy et al. 1964). Transparency variations are most evident in the middle layers but are perceivable in the outer, depending on the amount of weathering the shell has undergone. A range of fine growth lines are evident in the outer and middle shell layers. These include lines of sub-daily, daily (solar and/or tidal), fortnightly and lunar monthly frequency (Clark 1979). Because shell growth is greater during the juvenile (birth to sexual maturity, ca. 2 years) and mature (ca. 2-8 years) stages than during the senescent stage (older than 8 years), lines are most easily

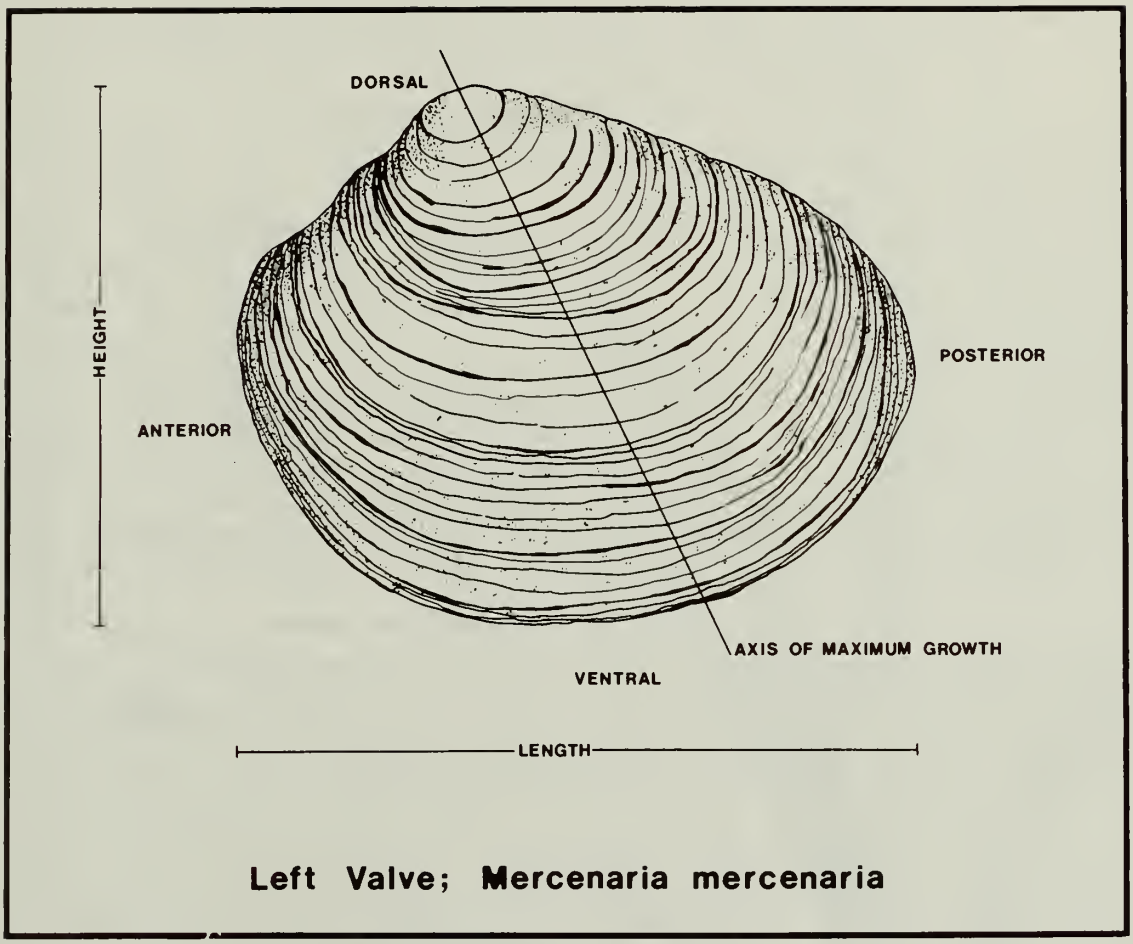
DORSAL
HEIGHT
ANTERIOR
POSTERIOR
AXIS OF MAXIMUM GROWTH
VENTRAL
LENGTH
Left Valve; Mercenaria mercenaria

FIGURE 12.1

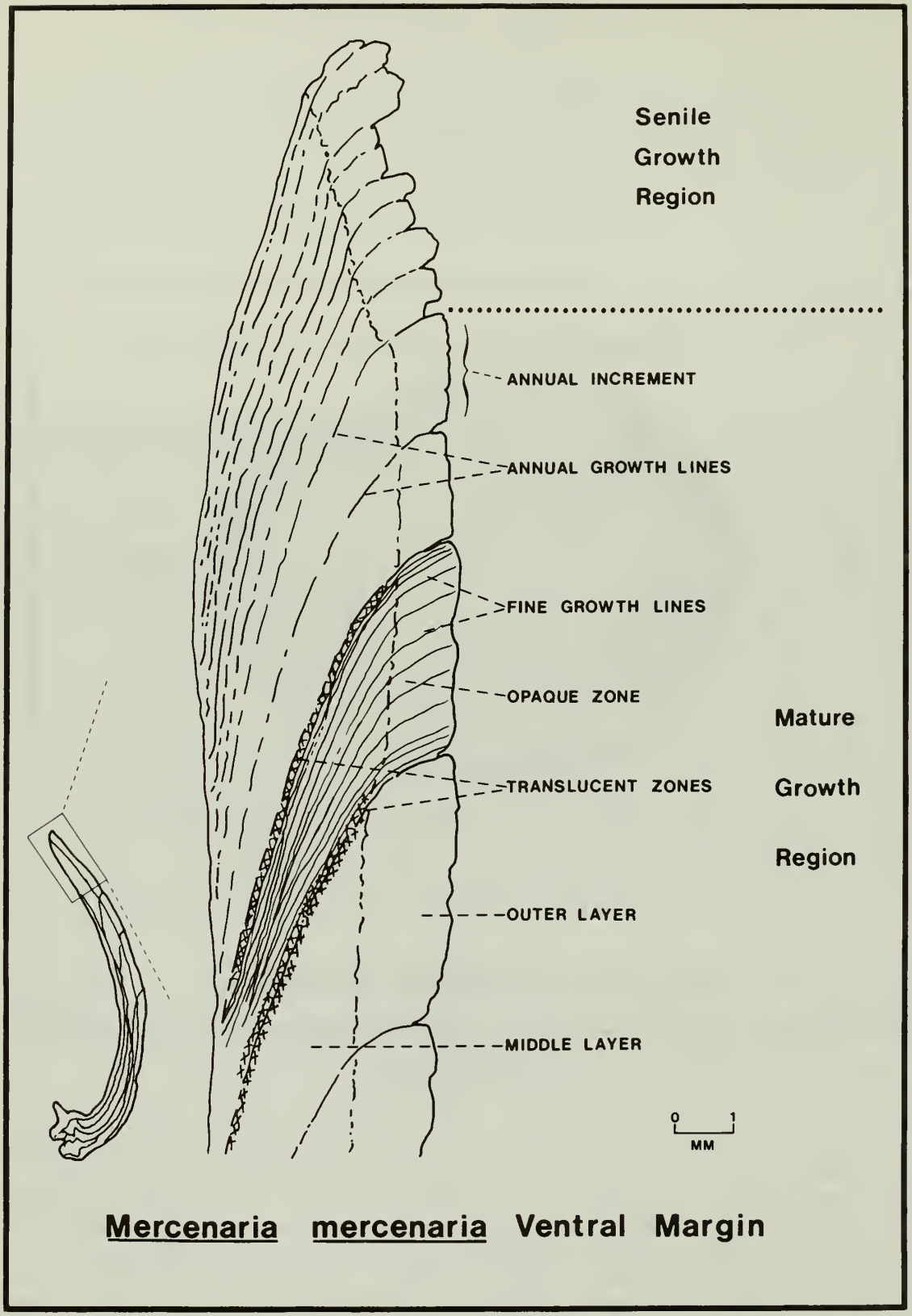
Senile
Growth
Region
ANNUAL INCREMENT
ANNUAL GROWTH LINES
FINE GROWTH LINES
OPAQUE ZONE
TRANSLUCENT ZONES
OUTER LAYER
MIDDLE LAYER
Mature
Growth
Region
0
1
MM
Mercenaria mercenaria Ventral Margin

FIGURE 12.2

distinguished in that portion of the shell which was deposited during the earlier stages.

Materials and Methods: Archeological Collection

Shells were selected for seasonality analysis from site areas having intact features, high artifact frequencies or densities, minimal disturbance, and/or good preservation. Intrasite spatial and stratigraphic units were defined using the analytical method and techniques described in Chapters 2, 3 and 7; units include concentrations, features and strata respectively. Criteria for shell selection within a given archeological unit included size, portion of valve represented by the fragment and condition. The last was the most limiting factor; surfaces were often eroded due to physical and/or chemical weathering. In many cases, a weathering rind, similar to a patination surface, had formed on exposed surfaces and extended to the interior portion of the shell obliterating distinctive growth structures. Weathered portion was detectable in thin section, but its extent was difficult to estimate by visual examination of uncut shell. Furthermore, laboratory washing contributed to further decay in many shells. Large fragments of the ventral portion (nearest the height axis, see Figure 12.1) were commonly used for thin-sections. At least ten usable specimens were sought from each provenience, though their weathered conditions often ultimately precluded their use in analysis.

Thin sections were prepared after the method described by Clark (1980). An initial cut (near the height axis) was made using a Buehler Isomet 11-1180, a low-speed, diamond-bladed saw. This surface was ground using successively finer grades of carborundum paper (#200, #400, #600) lubricated with water. When dry, the cut shell was affixed to a glass microscope slide using Devcon Five-minute epoxy. The resin was then allowed to dry for 8-12 hours to insure complete stabilization. After drying, the shell was cut again using the same saw to yield the actual thin section. The distance between feed arm and blade can be regulated to .001"; the sections were cut with thicknesses ranging between .010" and .015" (to allow light transmission). The newly cut surface was then ground and polished to eradicate striations caused by the sawing. Further polishing using finer, diamond paste grits may be advisable if acetate peels are to be made.

TABLE 12.1: Modern Shells Growth Data

A Month	B n	C % n in slow growth	D Shell growth in terminal year (%)	E % n with growth break at ventral edge	H Growth lines in terminal increment	F Purple at edge (%)	G Purple continues (%) beyond edge
Feb.	12	37%	59	75	52-64	25	
March	10	27%	58		81-84		9
April	12	0	75		107-117	22	
May	11	10	65		125-154		
June	13	0	69	54	162-172	15	
July	13	08	83	43	190-198	28	7
Aug.	10	22	76	92	242-260		8
Sept.			NO COLLECTION MADE				
Oct.	10	0	88		328-336		
Nov.	6	0	66		358-377		100
Dec.	12	0	87	50	16-24	24	82
Jan.			NO COLLECTION MADE				

All shells sectioned were in mature growth phases

Results: Shell Growth in Modern Collections

To determine annual growth cycle and identify seasonal growth indicators for *M. Mercenaria* from the local area of sites, a longitudinal collection of live quahogs was made. Similar sampling procedures have been used successfully for shell growth analyses in various species, e.g., *Mytilus edulis* (Lutz 1975, 1976); *Mercenaria mercenaria* (Claassen 1982; Clark 1979); *Mya arenaria* (Barber, personal communication 1981; Hancock 1982). Twenty to thirty individuals were collected each month for a year, with the exception of September 1981 and January 1982, from a site on Nauset Marsh in Eastham, Massachusetts (Figure 12.3). Ten to twelve mature specimens were selected from each sample for thin-sectioning and analysis. The modern shells were analyzed primarily to provide indices for estimation of season of death of the specimens that were collected from archeological sites surveyed and tested in the Outer Cape area. Growth indices were identified using the existing literature on shell growth in *M. mercenaria* and other intertidal invertebrates whose shells exhibit environmentally related periodicity in growth.

Modern growth data are summarized and presented on Table 12.1. A brief discussion of analytic methods and interpretation follows here. Columns A and B of Table 12.1 list collection date and sample size (sample size represents the number of individual left valves sectioned.) An effort was made to collect shells each month at approximately the same point during the lunar cycle and from the same tidal height zone on the flat.

Information in Columns C, D, and E was determined on the basis of examination of shell sections using a binocular microscope at 25X magnification. Annual height increments were measured along axis "H" (Figure 12.1) and are expressed in mm. Column C lists the percentage of the sample that was observed to be in slow growth phase at the time of death. Column D represents the measurement of final year of growth as a proportion of a growth index derived in the following way. Length of annual increments preceding the terminal increment were measured on each thin section. The mean of these measurements was calculated for each individual and the final year length measurement of each shell was divided by the average length of preceding growth measurements. The Column D values on this table represent the mean growth for each monthly sample achieved in the final year as a proportion of the average growth of all previous years.

Column E lists the percentage of all individuals in each month's sample that exhibited a growth break (Clark 1979) at their edge. Growth breaks did not, in all cases, accompany translucent (slow growth) zones. In Columns F and G are listed the percentages of individuals per sample whose shell was colored by purple pigment. The source and mechanism associated with the appearance of this pigment in *M. mercenaria* are not presently

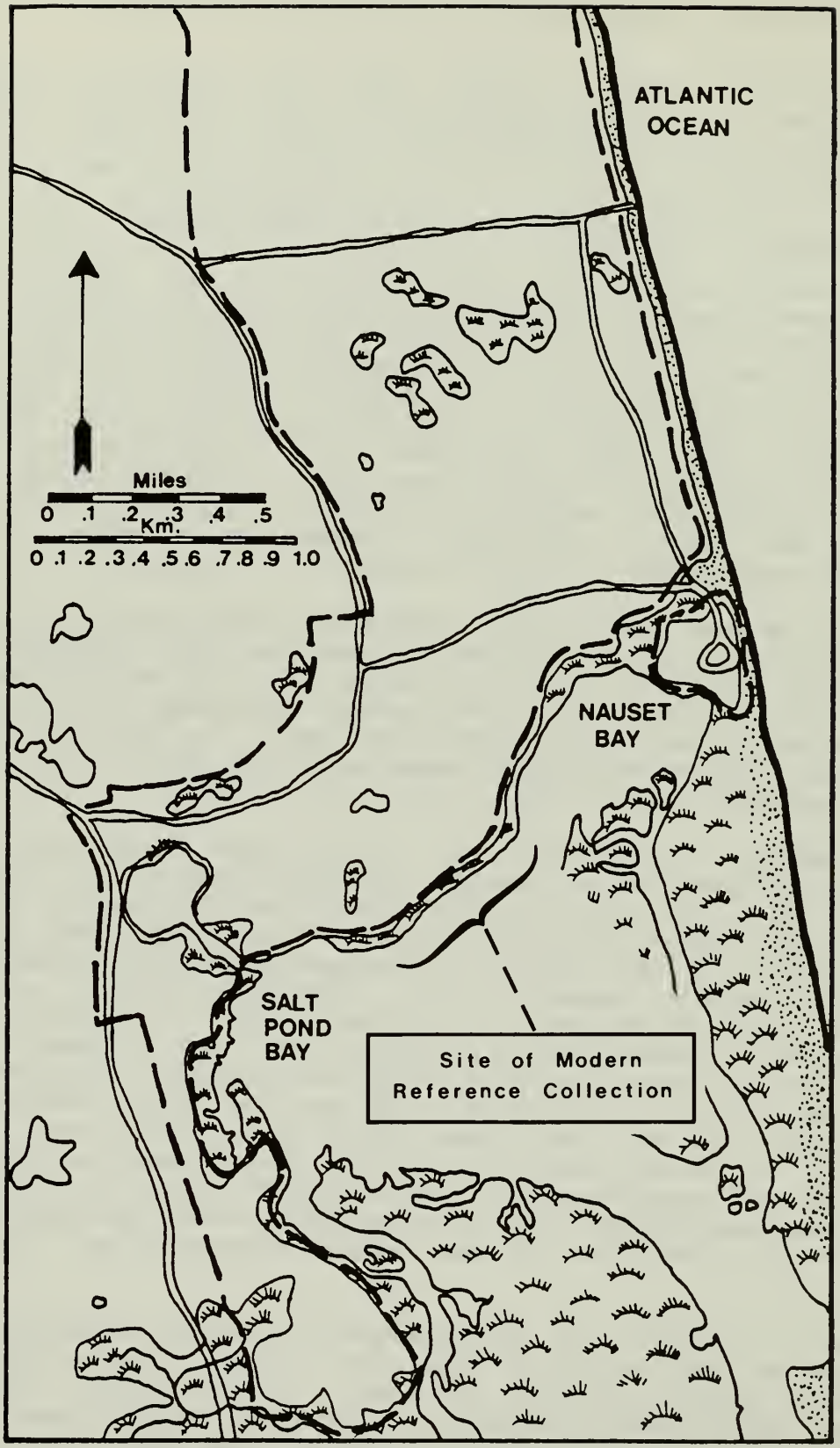
ATLANTIC
OCEAN
Miles
0 .1 .2 .3 .4 .5
Km.
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
NAUSET
BAY
SALT
POND
BAY
Site of Modern
Reference Collection

FIGURE 12.3

known though in sexually mature individuals, this pigment seems to exhibit some periodicity. In Column F, the proportion of shells with purple at the terminal edge only are listed; in G, the proportion of shells having continuous distribution of pigment (from the umbo to the edge) are recorded.

The data in Column H were derived via examination of sections at 100X magnification using a compound binocular microscope. Daily or circadian growth lines occurring in the terminal increments were counted. In this column the range of the number of lines counted for each monthly sample) is listed. The information also is represented graphically (Figure 12.4).

Season of Death Indicators

As Table 12.1 indicates, seasonal periodicity in modern shell growth does not produce distinctive or discrete morphological indicators. Rather, it is the case that markedly different stimuli may cause superficially similar responses. For example, growth breaks can occur in response to extremely high or extrememly low ambient temperature or in association with spawning, hence the presence of a growth break alone renders no definitive information about the season of its occurrence (Clark 1978; Kennish 1980; Lutz and Rhoads 1980). Given the fact that use of one indicator alone can and will lead to equivocal results, it is preferable to use a combination of attributes to infer season of death on an unknown. The significance of the indicators must be evaluated with respect to their demonstrated relationship to annual growth cycle. Accordingly, a brief discussion of the annual cycle of shell growth in this species is found below, based on information contained in the following sources: Ansell (1968); Barker (1970); Clark (1979); Davis and Calabrese (1964); Hopkins (1946); Kennish (1980); Pannella and MacClintock (1968). This is followed by an evaluation of the data in Table 12.1 and finally an outline of the procedures that were used for inferring season of death on the archeological specimens.

For juvenile and mature specimens, the fast growth phase is initiated in early spring, roughly contemporaneous with the first spring plankton bloom and initial rise in water temperature. Older and senescent individuals enter fast growth phase later and continue at that rate for a shorter period. Both increased food availability and higher ambient temperatures contribute to increased metabolic rate. This growth "spurt" is not timed identically for all individuals in a given locality. There can be a great deal of variation even in one area of the flat due to such endogenous factors as age and gamteogenesis, and to exogenous factors, e.g., sediment texture, relative crowding and flat disturbances such as digging.

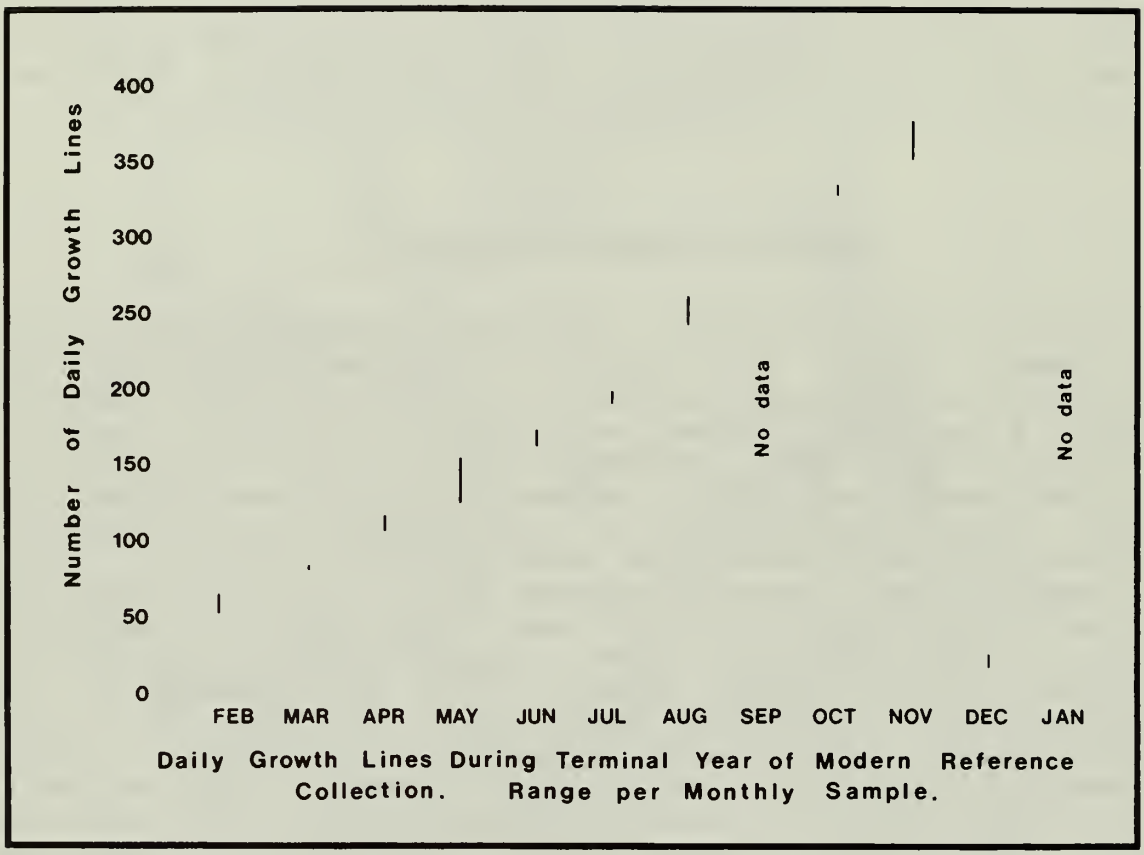
Number of Daily Growth Lines
400
350
300
250
200
150
100
50
0
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
No data
No data
Daily Growth Lines During Terminal Year of Modern Reference Collection. Range per Monthly Sample.

FIGURE 12.4

The period of rapid growth follows a slower phase. During the preceding winter months, both limited food and low temperature result in a lowered metabolic rate for most of the population although juvenile members appear to be less affected. This results in the translucent zone that is observed at shell edge. This seems to occur in late winter, though older individuals experience a relatively longer period of slow growth during the annual cycle.

The edge translucency in the February sample (37%) and the March sample (27%) is probably due to winter growth slowdown. However, the presence of a translucent zone is not incontrovertible evidence that the animal is in a slow winter phase; a limited number of May, July and August specimens exhibited the same feature. Such translucent zones can be associated with summer growth slowdown induced by high water temperatures and/or spawning.

Reference to Column E (Table 12.1) indicates that growth breaks due to heat stress occur in a large proportion of samples collected during the summer. Consequently, neither translucent zone nor growth breaks alone are definitive winter growth attributes; either can be a product of slow growth induced at various times of the year in response to different stimuli (see also Claassen 1982). Their simultaneous presence is, however, more frequently associated with winter growth in this sample. It is worth noting that the presence of either does seem to be either a late winter/early spring or an early-to-mid summer phenomenon in this collecton. Contrasting data for South Carolina populations are provided by Claassen (1982). She has suggested that slow growth zones are observable in some proportion of the population throughout the annual cycle.

Growth phases ("fast" and "slow") were not markedly reflected in monthly measurements of shell accretion reported in Column D of Table 12.1. Most individuals were in early stages of maturity, approximately 3-6 years old,and therefore subject to accelerated growth rates relative to older members of the population. "Fast" growth, as reflected in shell length measurements, prevailed during the better part of the annual cycle.

As reported in a number of sources (Clark 1974; Lutz and Rhoads 1977, 1980; Kennish 1980), M. mercenaria exhibits diurnal (circadian) growth lines which are products of short-term alternation of metabolic activities associated with tidal fluctuation. Other biologically and environmentally related metabolic changes are reflected in growth lines of greater and lesser resolution; annual, fortnightly and subdaily lines have been reported (Lutz and Rhoads 1980). In terms of composition, all the lines in a given shell incorporate a similar complex organic compound that contributes to the increased translucency of the line. The degree of translucency, hence the line's overall visibility, varies with type of line, i.e., its

periodicity; annual and semi-annual lines are visible to the naked eye whereas subdaily lines are only visible using electron microscopy.

Daily growth lines were clearly visible at 100X magnification. Those deposited during the terminal year of growth were counted for this study. The ranges for each month's sample are presented in Column H (Table 12.1). A total of 352-377 lines were found to have been deposited during the annual growth cycle for the sample as a whole. This corresponds to findings presented in earlier studies on growth line periodicity in this species (Rhoads and Pannella 1970; Pannella and MacClintock 1968).

It is obvious that counting growth lines provides the most accurate estimate of the time of death of an unknown, on the condition that an annual index, i.e., the point on the shell where one begins to count lines, exists. As discussed earlier the winter growth break provides this index. A further potential problem is imposed by the tediousnes of the task, which is aggravated by variations in line visibility, largely due to preparation methods and shell condition. It has been found that line counts can vary between individuals, for example. To help avoid this problem, in this study the author undertook all microscopic investigation under relatively constant conditions of observation. A final problem area is associated with the use of this method with archeological shells. The degree of weathering exhibited by these specimens often renders daily growth lines indistinguishable (see Clark 1979). Extensive weathering prohibited analysis of a large number of archeological specimens in this study.

Season of Death Estimates: The Archeological Shells

Based on the foregoing information, a number of indicators for the determination of season of death were used. Number of daily growth lines deposited during terminal year were counted when possible in well-preserved, mature specimens. Based on known ranges of lines per month in modern samples, an estimate of time of death was made. If the number of lines counted was within the range observed for modern shells collected during a given month, that month was noted (Column E of the tables listing the archeological specimens in each area). If the number of lines counted fell between ranges of consecutive months, both months were noted. If the shell was in a winter slow-growth phase at the time of death, that information alone was recorded.

For senescent individuals, growth phase ("fast" or "slow") at time of death was recorded. Counting daily lines was difficult or impossible due to their compression on such shells. Review of available literature on growth for this species in the

Cape Cod region suggests that "fast" growth (reflected by shell opacity) is limited to a relatively brief period during the annual cycle, i.e., times of food availability and optimum tenperatures which co-occur in spring. For these older individuals, the greater part of the annual cycle is characterized by "slow" growth (relative to the rate exhibited by other members of the population). This latter category encompasses a broad period, hence precise inferences about time of death are not possible.

Two other attributes were noted in the course of this analysis, though they proved to have little utility in the present undertaking and are not included in the archeological data tables. First, the presence and distribution of purple pigment was recorded; this information may have some future value, though its present applicability is limited. Secondly, the lengths of terminal annual increment were noted, though due to lack of modern monthly variation in this variable it had little value for season of death assessment.

Results of analysis of archeological shells are organized by site, concentration, stratum, and feature (data are in Table 12.2a-h) and are discussed below.

Archeological Specimens, Fort Hill Area

19BN308 (Table 12.2a; Foldout Map D)

Six shells from Concentration 308.11, Stratum I were sectioned; 5 were analyzed. Two specimens were in the mature growth stage; estimated time of death was during winter. The 3 remaining shells represented senescent individuals; 2 were collected during "slow" phase, one was collected during "fast". No seasonally restricted collection period is inferrable.

Two shells from Stratum II of Concentration 308.11 were sectioned and analyzed. Both were in the senescent growth stage; one was collected during its fast growth phase, the other during its "slow" growth phase. No discrete collection period can be estimated.

Five shells from Concentration 308.33, Stratum II were sectioned. Four mature specimens were analyzed and a late winter to early spring period of collection is indicated.

Concentration 308.42, Stratum II contained a number of excavation units with very large shell quantities. In two of these units, discrete stratigraphic lenses of shell were identified. These deposits were labeled and removed as features; shells from a number of these features were sectioned so that in addition to identification of collection season, we could try to

TABLE 12.2a
Seasonality Data for Archeological Shell Specimens
Fort Hill Area, 19BN308

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 308.11, Stratum I					
0304-00-010	2	Mature(M)	64	--	February
0304-00-010	4	M	--	slow	--
0304-00-010	1	S	--	slow	--
0304-00-010	3	S	Weathered(W)	--	--
0304-00-010	5	S	--	slow	--
0304-00-010	6	S	--	fast	--
Concentration 308.11, Stratum II					
0304-00-020	1	Senescent(S)	--	fast	--
0304-00-020	2	S	--	slow	--
Concentration 308.33, Stratum II					
0300-00-043	2	M	104	--	Mar/Apr
0300-00-043	3	M	76	--	Feb/Mar
0300-00-043	4	M	71	--	Feb/Mar
0300-00-043	5	M	--	slow	--
0300-00-043	1	S	W	--	--
Concentration 308.42, Stratum II					
0107-02-039	1	M	78	--	Feb/Mar
0107-02-039	2	M	W	--	--
0107-02-039	3	M	W	--	--
0107-02-039	4	M	W	--	--
0107-02-039	5	M	W	--	--
0107-03-039	1	M	--	slow	--
0107-03-039	2	M	--	slow	--
0107-03-039	3	M	--	slow	--
0107-03-039	4	M	--	slow	--
0107-04-039	2	M	27	--	Dec/Feb
0107-04-039	5	M	--	--	--
0107-04-039	6	M	64	--	February
0107-04-039	1	S	W	--	--
0107-04-039	4	S	W	--	--

TABLE 12.2a (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
0107-05-039	1	M	W	--	--
0107-05-039	2	M	--	slow	--
0107-05-039	3	M	--	slow	--
0107-06-051	2	M	172	--	June
0107-06-051	3	M	180	--	Jun/Jul
0107-06-051	6	M	194	--	July
0107-06-051	7	M	92	--	Mar/Apr
0107-06-051	8	M	--	slow	--
0107-06-051	4	M	W	--	--
0107-06-051	1	S	--	fast	--
0107-06-051	5	S	--	fast	--
0107-06-051	9	S	W	--	--
0112-04-037	4	M	41	--	Dec/Feb
0112-04-037	6	M	47	--	Dec/Feb
0112-04-037	1	M	W	--	--
0112-04-037	2	M	W	--	--
0112-04-037	3	M	W	--	--
0112-04-037	5	M	W	--	--
0112-05-037	1	M	29	--	Dec/Feb
0112-05-037	3	M	43	--	Dec/Feb
0112-05-037	5	M	39	--	Dec/Feb
0112-05-037	9	M	62	--	March
0112-05-037	10	M	--	slow	--
0112-05-037	11	M	74	--	Mar/Apr
0112-05-037	2	M	W	--	--
0112-05-037	4	M	W	--	--
0112-05-037	8	M	W	--	--
0112-05-037	6	S	--	fast	--
0112-05-037	7	S	--	fast	--
0112-06-037	4	M	34	--	Dec/Feb
0112-06-037	8	M	42	--	Dec/Feb
0112-06-037	1	M	W	--	--
0112-06-037	2	M	W	--	--
0112-06-037	5	M	W	--	--
0112-06-037	6	M	W	--	--
0112-06-037	3	S	W?	fast	--
0112-06-037	7	S	?	fast	--
0112-07-037	1	M	33	--	Dec/Feb
0112-07-037	3	M	20	--	December
0112-07-037	5	M	61	--	February
0112-07-037	6	M	117	--	April
0112-07-037	2	S	--	fast	--
0112-07-037	4	S	--	fast	--

TABLE 12.2a (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
0112-08-037	1	M	28	--	Dec/Feb
0112-08-037	2	M	12	--	December
0112-08-037	3	M	17	--	December
0112-08-037	4	M	--	slow	--
0112-08-037	5	M	32	--	Dec/Feb
Concentration 308.71, Stratum I					
0005-00-043	1	M	W	--	--
0005-00-043	8	M	132	--	May
0005-00-043	5	S	--	slow	--
0005-00-043	6	S	W	--	--
0005-00-043	7	S	W	--	--
0001-00-040	1	S	W	--	--
0001-00-040	2	S	W	--	--
Concentration 308.71, Stratum II					
0007-01-085	1	S	W	--	--
0007-01-085	2	S	W	--	--
0007-01-085	3	S	W	--	--
0007-01-076	1	S	--	fast	--
0007-01-076	2	S	--	fast	--
0007-01-076	3	S	W	--	--
0007-01-076	4	S	W	--	--
0007-01-076	5	M	42	--	Dec/Feb
0007-01-066	1	S	W	--	--
0007-01-066	2	S	W	--	--
0007-01-066	3	S	W	--	--
0007-01-066	4	S	W	--	--
0007-01-055	1	S	W	--	--
0007-01-055	2	S	W	--	--
0007-01-055	3	S	W	--	--
0007-01-060	1	S	--	fast	--
0007-01-060	2	S	--	fast	--

determine whether discrete depositional events were represented by the lenses.

From Excavation Unit 107, shells from Features 2-6 were sectioned. One mature specimen (out of a total of 5) from Feature 2 was analyzed. Time of death was estimated between the end of winter and very early spring. A total of 9 shells (out of 12) were selected from Features 3, 4, and 5. All represented mature individuals and winter deaths were estimated for all specimens. Seven shells (out of a total of 9) were drawn from Feature 6 for analysis. Four represented mature individuals; spring and early summer deaths were estimated for 3. Winter death was estimated for the fourth. Two shells in senescent developmental stage were analyzed; both were in "fast" growth phase. A broader range of collection periods was represented by the sample from Feature 6, minimally from winter through early summer.

Shells from Features 4-8 in Excavation Unit 112 were sectioned. Seven shells (from a total of 11) from Features 4 and 8 were analyzed. All represented mature individuals and winter deaths were estimated.

No discrete seasonal period of collection was inferrable from analyses of shells from Features 5, 6, and 7. Seventeen shells (out of a total of 25) were examined.

In Stratum I of concentration 308.71 two shells (from a total of 5) from Excavation Unit 5 were sectioned and read. One individual died during the mature stage; season of death was estimated as late spring. The second was senescent; death occurred during "slow" growth phase. Minimal per iod of collection during spring was posited, though the senescent shell may be evidence of a wider seasonal range. Two shells from Excavation Unit 5 were sectioned. Both were extensively weathered.

In Concentration 308.71, Stratum II, seventeen shells (5 of which were readable) from Feature 1 in Excavation Unit 7 were sectioned. One represented a mature individual and winter death. The 4 other shells represented senescent individuals and had been collected during "fast" growth phase. Collection during winter and spring could be inferred.

19BN323 (Table 12.2b; Foldout Map D)

Five shells from Concentration 323.21, Stratum I were sectioned; 3 were deeply weathered. The remaining 2 consisted of one senescent specimen which was in "slow" growth phase, and one mature specimen estimated as an early spring death. This small sample and the potential range of death times represented precludes a seasonality estimate.

TABLE 12.2b
Seasonality Data for Archeological Shell Specimens
Fort Hill Area, 19BN323

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 323.21, Stratum I					
0009-00-000	1	M	W	--	--
0009-00-000	2	M	W	--	--
0009-00-031	2	M	W	slow	--
0009-00-031	3	M	17	--	December
0009-00-031	1	S	W	--	--
Concentration 323.22, Stratum I					
0003-00-000	1	M	102	--	Mar/Apr
0003-00-000	3	M	64	--	February
0003-00-000	5	M	48	--	Dec/Feb
0003-00-000	2	S	--	fast	--
0003-00-000	6	S	--	slow	--
0003-00-000	8	S	--	fast	--
0003-00-000	9	S	--	fast	--
0003-00-000	10	S	--	slow	--
0003-00-000	4	S	W	--	--
0003-00-000	7	S	W	--	--
0007-00-036	3	M	--	slow	--
0007-00-036	5	M	--	slow	--
0007-00-036	9	M	70	--	Feb/Mar
0007-00-036	10	M	36	--	Dec/Feb
0007-00-036	3	M	67	--	Feb/Mar
0007-00-036	1	S	--	slow	--
0007-00-036	2	S	--	fast	--
0007-00-036	4	S	--	fast	--
0007-00-036	6	S	--	fast	--
0007-00-036	7	S	--	fast	--
0007-00-036/065	8	M	W	--	--
0007-00-036/065	--	S	--	fast	--
0007-00-036/065	11	S	W	--	--
0007-00-036/065	1	S	W	--	--
0007-00-036/065	2	S	W	--	--
0007-00-036/065	4	S	W	--	--
0020-00-031	10	M	--	slow	--
0020-00-031	11	M	--	slow	--
0020-00-031	12	M	24	--	December
0020-00-031	15	M	--	slow	--

TABLE 12.2b (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
0020-00-031	3	M	--	slow	--
0020-00-031	9	M	W	--	--
0020-00-031	1	S	W	--	--
0020-00-031	4	S	--	fast	--
0020-00-031	6	S	--	fast	--
0020-00-031	7	S	W	--	--
0020-00-031	8	S	W	--	--
0020-00-031	13	S	--	slow	--
0020-00-031	14	S	W	--	--
0020-00-000	7	S	W	--	--
Concentration 323.22, Stratum II					
0012-00-036	1	M	--	slow	--
0012-00-036	6	M	--	slow	--
0012-00-036	8	M	--	slow	--
0020-00-042	2	M	--	slow	--
0020-00-042	3	M	--	slow	--
0020-00-042	1	S	--	slow	--
0020-00-042	1	S	--	fast	--
0020-00-072	2	M	--	slow	--
0012-01-036	2	M	41	--	Dec/Feb
0012-01-036	3	M	40	--	Dec/Feb
0012-01-036	1	M	--	slow	--
0012-01-063	5	M	37	--	Dec/Feb
0012-01-063	2	M	--	slow	--
0012-01-070	1	M	21	--	December
0012-01-070	2	M	22	--	December
0012-01-063	1	S	--	fast	--
0012-01-063	4	S	--	fast	--
0012-01-080	2	M	16	--	December
0012-01-080	1	S	--	slow	--
0012-00-036	3	S	W	--	--
0012-00-042	2	S	--	--	--
0012-00-042	4	S	W	--	--
0012-00-042	5	S	--	slow	--
0012-00-072	7	S	W	--	--
0012-00-072	3	S	W	--	--

TABLE 12.2b (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 323.23, Stratum I					
0008-00-011	1	M	24	--	December
0008-00-011	2	M	16	--	December
0008-00-011	3	M	--	slow	--
0008-00-011	4	M	--	slow	--
0008-00-011	6	M	--	slow	--
0008-00-011	7	M	--	slow	--
0008-00-020	1	M	--	slow	--
0008-00-020	3	M	--	slow	--
0008-00-020	2	M	W	--	--
0008-00-020	5	M	W	--	--
0008-00-020	4	S	W	--	--
0008-00-020	6	S	W	--	--

Forty shells from Concentration 323.22, Stratum I were sectioned; 13 were weathered, 27 were readable. Thirteen of the latter were mature; death times were estimated between winter and early spring. Senescent individuals comprised the remainder of the sample; 10 had been killed during "fast" growth phase and 45 during "slow". Minimally, this sample as a whole represented collection period between winter and late spring.

From Stratum II of the same concentration, 25 shells were sectioned. Four were weathered, leaving an analyzable sample of 21. Fourteen of these were in mature growth stage; winter and possibly very early spring deaths were inferred. Seven were senescent; 4 were in "slow", and 3 were in "fast" growth phases. A wider range of death dates is indicated for senescent shells, possibly including the entire annual cycle. While this maximum estimate may be made on the basis of senescent individuals, the sample as a whole supports a minimum estimate of winter through late spring collection periods.

Eleven shells of the above group were drawn from Feature 1, Excavation Unit 20. This subsample consisted of 8 mature shells with estimated winter death dates and three senescent shells, 2 of whose deaths occurred during "fast" phase; the last died during "slow" growth phase. A discrete seasonal period of collection is not represented by this group of shells. The broader estimate of winter through late spring or possibly year round collection is supported.

The final locus sampled at 19BN323 was Concentration 323.23, Stratum I. Twelve shells were sectioned, 4 were weathered, 8 were readable. The latter were all in mature stages of development and winter deaths were inferred.

Archeological Specimens, Southern Side of Salt Pond

19BN273/275 (Table 12.2c; Foldout Map E)

Many of the shells excavated at this site were weathered deeply which resulted in a small number of shells being sectioned. Five shells from Concentration 273/275.31, Stratum I were sectioned. Two were extensively weathered, only three were readable. The latter were senescent; two were collected during "slow" growth, one was collected during "fast" growth. No seasonal collection period can be inferred.

19BN274/339 (Table 12.2d; Foldout Map E)

As with 19BN273/275, observable weathering prohibited sectioning of the majority of the collection. Five shells from Concentration 274/339.11, Stratum I were sectioned and analyzed;

TABLE 12.2c
Seasonality Data for Archeological Shell Specimens
Southern Side of Salt Pond, 19BN273/275

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 273/275:31, Stratum I					
0005-00-000	1	S	--	fast	—
0005-00-000	3	S	--	slow	--
0005-00-000	4	S	--	slow	—
0005-00-000	2	S	W	--	--
0005-00-000	5	S	W	--	--

TABLE 12.2d
Seasonality Data for Archeological Shell Specimens
Southern Side of Salt Pond, 19BN274/339

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 274/339.11, Stratum I					
0014-00-000	1	M	74	--	Feb/Mar
0014-00-000	2	M	89	--	Mar/Apr
0014-00-000	3	M	32	--	Dec/Feb
0014-00-000	4	M	81	--	March
0014-00-000	5	S	--	fast	--
Concentration 274/339:12, Stratum I					
0019-00-000	1	M	W	--	--
0023-00-020	7	M	88	--	Mar/Apr
0023-00-020	1	S	--	slow	--
0023-00-020	5	S	--	fast	—
0012-00-027	1	S	W	--	--
0012-00-027	2	S	W	--	--
0012-00-027	3	S	W	--	--
0022-00-020	2	S	W	--	--
0022-00-020	3	S	W	--	--
0022-00-020	4	S	W	--	--
0022-00-020	5	S	W	--	--

four were mature with line counts similar to modern specimens collected in early and later spring months. One senescent individual was represented; this had been collected during a fast growth period. Times of death for the analyzed sample indicate spring collection.

Eleven shells from Concentration 12, Stratum I were sectioned though eight were deeply weathered leaving only three as a readable sample. Two were senescent; one was colected during "slow", the other during "fast" phase. The remaining shell was mature; its number of lines counted fell between the modern March and April ranges. Minimally, this very small sample represents collection during spring, though a more extensive collection period is possible.

Fifty percent of the total sampled shell from this site were weathered. Consequently, seasonal estimates remain tentative and should be corroborated with evidence from other indicators.

19BN341 (Table 12.2e; Foldout Map E)

Twenty-eight shells from Concentration 341.21, Stratum I were sectioned; 6 were weathered, 22 analyzed. Thirteen of the latter represented mature individuals; times of death were distributed equally over a period between early spring and late summer. The remaining shells were senescent; one was collected during "slow" growth, 8 were collected during "fast" growth phase. No discrete collection period was interpretable from these shells, though the representation of a range of collection episodes from early spring through late summer can be inferred.

Twenty-two shells, 17 of which were readable, from Concentration 341.21, Stratum II were sectioned. Fourteen were mature; deaths were estimated to occur between late winter/early spring and early summer, though the line counts on the majority (10/14) corresponded to the period between December and March in the modern sample. The remaining 3 shells were senescent; two were in "slow", one in "fast" phase.

Two shells, both senescent, from Concentration 341.24, Stratum I and II, respectively, were sectioned. Both were in "slow" growth phases; no seasonal collection period could be inferred.

No discrete seasonal collection period can be suggested from the site sample as a whole. A range, extending minimally from early spring or late winter to late summer is represented though the presence of specimens in "slow" growth may indicate a broader range of collection periods.

TABLE 12.2e
Seasonality Data for Archeological Shell Specimens
Southern Side of Salt Pond, 19BN341

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 341.21, Stratum I					
0017-00-013	1	M	162	--	June
0017-00-013	5	M	173	--	Jun/Jul
0017-00-013	7	M	212	--	Jul/Aug
0017-00-013	8	M	155	--	May/Jun
0017-00-013	9	M	75	--	Feb/Mar
0017-00-013	10	M	254	--	August
0017-00-013	11	M	67	--	Feb/Mar
0017-00-013	12	M	67	--	Feb/Mar
0017-00-013	5	S	--	slow	--
0017-00-013	6	S	--	fast	--
0017-00-013	7	S	--	fast	--
0017-00-013	3	S	--	fast	--
0017-00-013	1	S	--	fast	--
0022-00-020	1	M	W	--	--
0022-00-020	2	S	W	--	--
0022-00-020	3	S	W	--	--
0023-00-020	1	M	134	--	May
0023-00-020	2	M	102	--	Mar/Apr
0023-00-020	3	M	125	--	May
0023-00-020	4	M	117	--	April
0023-00-020	5	M	147	--	May
0017-00-013	2	S	--	fast	--
0017-00-013	4	S	--	fast	--
0017-00-013	13	S	--	fast	--
0017-00-013	14	S	--	fast	--
0017-00-013	3	S	W	--	--
0017-00-013	6	S	W	--	--
0017-00-013	15	S	W	--	--

TABLE 12.2e (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 341.21, Stratum II					
0017-00-031	1	M	70	--	Feb/Mar
0017-00-031	2	M	77	--	Feb/Mar
0017-00-031	3	M	64	--	February
0017-00-031	6	M	54	--	February
0017-00-031	7	M	72	--	Feb/Mar
0017-00-031	11	M	66	--	Feb/Mar
0017-00-031	12	M	154	--	May
0017-00-031	13	M	74	--	Feb/Mar
0023-00-034	1	M	94	--	Mar/Apr
0023-00-034	3	M	144	--	May
0023-00-034	4	M	32	--	Dec/Feb
0023-00-034	5	M	65	--	Feb/Mar
0023-00-034	6	M	37	--	Dec/Feb
0023-00-034	7	M	107	--	April
0017-00-031	4	M	W	--	--
0017-00-031	5	M	W	--	--
0017-00-031	9	M	W	--	--
0017-00-031	3	S	--	slow	--
0017-00-031	4	S	--	fast	--
0017-00-031	7	S	--	slow	--
0017-00-031	1	S	W	--	--
0023-00-034	8	S	W	--	--
Concentration 341.24, Stratum I					
0019-00-024	1	S	--	slow	--
Concentration 341.24, Stratum II					
0020-01-033	--	S	--	slow	--

Archeological Specimens, Northern Side of Salt Pond

19BN288 (Table 12.2f; Foldout Map F)

Nine shells from Concentration 288.33, Stratum I were sectioned; 56 were readable. The 5 specimens were senescent; four were in "slow" and one in "fast" growth phases. No discrete collection period could be inferred for this locus, though a minimum span from winter through late spring could be identified. Although winter collection periods were inferrable from the majority of shells from this concentration, the portion of the sample represented by senescent individuals in both "slow" and "fast" growth may indicate a wider range, possibly year-round, of collection periods.

Eleven shells from Concentration 288.42, Stratum I were sectioned. 8 were mature. Estimated dates of death ranged from winter through late spring. The remaining 3 were senescent; one was in "fast" and one in "slow" growth phases. The majority of shells from this concentration were collected between winter and late spring, though the analysis of senescent shells indicates the possibility of a broader range of collection times.

Forty-six shells from Concentration 288.42, Stratum II were sectioned. Twenty-six were analyzed. Sixteen were mature and estimated season of death was winter in all cases, with one exception (spring). Ten were senescent, 6 were in "fast" growth phases, 4 were in "slow" phases. Discrete seasonal exploitation periods were not identified for this concentration in either Stratum I or II. A range of collection periods, minimally between winter and late spring, was identified.

Four shells from Concentration 288.52, Stratum I were sectioned, though only 2 were readable. One was mature and winter death estimated. The second was senescent and in "slow" growth phase. Minimally, a winter collection period can be inferred, though the very small sample size and the potentially wide range that the senescent shell could represent could broaden this estimate.

Shells from three other concentrations (.22, .31, and .57) were also sectioned and analyzed. No single season of procurement is indicated for any of them.

In general throughout 19BN288, collection periods for shells from upper stratigraphic levels (Stratum I) were broader than estimates for shells from Stratum II. This may reflect mixing due to plowing and other post-depositional disturbance. Shells from lower levels, though not representative of discrete collection times, did present a slightly more restricted range of collection periods, with winter deaths estimated for the majority, and a minimum collection range from winter to late spring suggested.

TABLE 12.2f
Seasonality Data for Archeological Shell Specimens
Northern Side of Salt Pond, 19BN288

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 288.33, Stratum I					
0006-00-000	1	S	W	--	--
0006-00-000	2	S	W	--	--
0006-00-000	3	S	W	--	--
0006-00-010	1	S	--	slow	--
0006-00-010	2	S	W	--	--
0006-00-010	3	S	--	fast	--
0006-00-010	4	S	--	slow	--
0006-00-010	5	S	--	slow	--
0006-00-010	6	S	--	slow	--
Concentration 288.42, Stratum I					
0001-00-010	3	M	74	--	Mar/Apr
0001-00-010	5	M	65	--	Mar/Apr
0001-00-010	6	M	52	--	February
0001-00-010	7	M	40	--	Dec/Feb
0001-00-010	9	M	48	--	Dec/Feb
0001-00-010	10	M	--	slow	--
0001-00-010	11	M	--	slow	--
0001-00-010	12	M	--	slow	--
0001-00-010	4	S	W	--	--
0001-00-010	2	S	--	fast	--
0001-00-010	8	S	--	slow	--
Concentration 288.42, Stratum II					
0001-00-020	13	M	--	slow	--
0001-00-020	5	M	134	--	May
0001-00-020	6	M	--	slow	--
0001-00-020	7	M	27	--	Dec/Feb
0001-00-020	4	M	W	--	--
0001-00-020	8	M	W	--	--
0001-00-020	1	M	W	--	--
0001-00-020	2	M	W	--	--
0001-00-020	3	M	W	--	--
0001-00-020	9	S	--	slow	--
0001-00-020	10	S	--	fast	--
0001-00-020	2	M	--	slow	--
0001-00-020	3	M	--	slow	--
0001-00-020	1	S	W	--	--

TABLE 12.2f (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 288.42, Stratum II					
0001-00-030	1	M	47	--	Dec/Feb
0001-00-030	2	M	52	--	February
0001-00-030	5	M	--	slow	--
0001-00-030	7	M	40	--	Dec/Feb
0001-00-030	8	M	32	--	Dec/Feb
0001-00-030	3	M	--	slow	--
0001-00-030	4	M	--	slow	--
0001-00-030	3	M	24	--	December
0001-00-030	6	M	W	--	--
0001-00-030	9	S	--	slow	--
0001-00-030	10	S	--	slow	--
0001-00-040	6	M	--	slow	--
0001-00-040	10	M	W	--	--
0001-00-040	1	S	W	--	--
0001-00-040	2	S	W	--	--
0001-00-040	3	S	W	--	--
0001-00-040	4	S	W	--	--
0001-00-040	5	S	W	--	--
0001-00-040	7	S	W	--	--
0001-00-040	8	S	W	--	--
0001-00-040	9	S	W	--	--
0001-00-041	2	M	--	slow	--
0001-00-041	5	S	--	slow	--
0001-00-041	1	S	W	--	--
0001-00-051	5	S	--	fast	--
0001-00-051	6	S	--	fast	--
0001-00-051	8	S	--	fast	--
0001-00-051	9	S	--	fast	--
0001-00-051	2	S	--	fast	--
0001-00-051	3	S	W	--	--
0001-00-051	4	S	W	--	--
0001-00-051	1	S	W	--	--

TABLE 12.2f (continued)

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 288.52, Stratum I					
0009-00-038	4	M	33	--	Dec/Feb
0009-00-038	1	S	--	slow	--
0009-00-038	2	S	W	--	--
0009-00-038	3	S	W	--	--
Concentration 288.22, Stratum I					
STP 1203	5	M	34	--	Dec/Feb
STP 1203	3	M	--	slow	
STP 1203	1	S	--	fast	--
STP 1203	2	S	--	fast	--
STP 1203	4	S	--	fast	--
STP 1203	6	S	--	fast	--
Concentration 288.31, Stratum I					
STP 1124	1	S	W	--	--
Concentration 288.57, Stratum I					
STP 979	2	S	--	fast	--
STP 979	3	S	--	fast	--
STP 979	4	S	--	fast	--
STP 979	6	S	--	fast	--
STP 979	7	S	--	fast	--
STP 979	1	S	W	--	--
STP 979	5	S	W	--	--
STP 1105	1	S	--	slow	--

19BN390 (Table 12.2g; Foldout Map F)

Eight shells from Concentration 390.33, Stratum II were sectioned. Extensive weathering prohibited an analysis of 2; 5 of the remaining 6 were mature with winter deaths estimated for 4 and an early spring death estimated for one. The sixth shell analyzed was senescent; death occurred during "fast" growth phase. All shells were drawn from Feature 01 in Excavation Unit 9. Collection periods between winter and late spring were inferred with winter deaths represented in the majority of the collection.

Archeological Specimens, Provincelands

19BN410 (Table 12.2h; Foldout Map M)

This site yielded a smaller quantity of shell in comparison with other sites reported here; in addition most shells were very poorly preserved. Eleven specimens were selected for sectioning, though only 4 were analyzed. All four were in the mature stage. Winter and spring deaths were estimated.

Discussion

Fort Hill Area

A fairly broad range of collection periods was represented at most sample loci on sites in this area. Intersite variability was noted, though only to a limited degree.

Little evidence for tightly restricted seasonal shellfish exploitation was found at 19BN308. Shells from most concentrations, as well as excavation units or features within concentrations, represented a range of seasonal collection periods.

Seasonally restricted collection and/or depositional events were represented, however, by materials analyzed from a number of features, i.e., Features 2-6 in Excavation Unit 107 and Features 6 and 8 in Excavation Unit 112, both units within Concentration 308.42. It is likely that these shell lenses represent single depositional events during the period of the site's prehistoric occupation. Analysis of shell from other individual loci on this site suggested comparatively broader seasonal ranges in collection activities.

The above conclusion may reflect the degree of post-depositional mixing of archeological deposits in most of the

TABLE 12.2g
Seasonality Data for Archeological Shell Specimens
Northern Side of Salt Pond, 19BN390

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
Concentration 390.33, Stratum II					
009-01-081(NE)	1	M	62	--	February
009-01-081(NE)	2	M	52	--	February
009-01-081(NE)	3	M	39	--	Dec/Feb
009-01-080(E)	1	M	84	--	March
009-01-081(S)	1	M	29	--	Dec/Feb
009-01-081(S)	2	S	W	--	--
009-01-081(S)	4	S	W	--	--
009-01-081(S)	3	S	--	fast	--

TABLE 12.2h
Seasonality Data for Archeological Shell Specimens
Northern Side of Salt Pond, 19 BN 410

Provenience	Specimen Number	Age Class	Number of Daily Lines	Growth Phase	Corresponding Modern Coll. Month
0003-00-000	7	M	34	--	Dec/Feb
0003-00-000	1	M	W	--	--
0003-00-000	2	M	W	--	--
0003-00-000	3	M	W	--	--
0003-00-000	4	--	--	--	--
0003-00-000	5	--	--	--	--
0003-00-000	6	M	--	--	--
0007-00-000	1	M	--	--	Feb/Mar
0007-00-000	2	M	--	--	Feb/Mar
0007-00-000	3	M	--	--	Apr/May
0007-00-000	4	M	W	--	--

concentrations tested for this analysis at 19BN308. Alternatively, the remains suggest the existence of a wide seasonal range for shellfish exploitation and site utilization during the entire period of its occupation.

Shells from Stratum I of all concentrations sampled on 19BN323 had estimated seasons of death ranging from winter through late spring, minimally. Winter deaths were, however, inferred for the majority of the sample. Some intrasite variability was observed; season of death for all shells from Concentration 323.23, Stratum I was estimated as winter.

A similar pattern was obtained for shells from Stratum II loci. Collections ranging from winter through late spring were represented by samples from all concentrations, though the majority of shells were identified as winter kills.

The Salt Pond Area

Three of the 4 site areas from the southern side of Salt Pond (19BN273/275; 19BN274/339; 19BN341) were sampled for seasonality analyses. Shells from 19BN273/275 and 19BN274/339 tended to be poorly preserved which allowed only a small number to be analyzed. The better-preserved collection from 19BN341 yielded more specimens for analysis.

Discrete seasonal collection periods were not inferrable from analyses of material from 19BN273/275.

Shells from each individual sample locus in 19BN274/339 yielded evidence for spring collections. However, the poor quality of the material and the small sample sizes underscore the need for additional analyses of other seasonal indicators.

Winter, spring and summer collections were identified in analyses of shell from all sampling loci in 19BN341, though discrete collection periods were not evident within individual loci of samples.

Two sites (19BN288 and 19BN390) that yielded large quantities of shell were found in the area east of Salt Pond. In general, both sites had a good deal of evidence supporting winter collection, though small numbers of shells with estimated spring deaths were present. Three concentrations each with two strata sampled in 19BN288, yielded results consistent with the above observations, though in all cases, the shells in Stratum II revealed a preponderance of winter deaths.

Concentration 390.33, Stratum II in 19BN390 produced results consistent with observations for the 19BN288 specimens, i.e., winter through late spring collection.

The Provincelands

A small number of shells from 19BN410 in the Provincelands area were sectioned and analyzed. Extensive weathering and the small size of the overall collection limited the number of shells that could be analyzed. Winter and spring deaths were identified; no discrete collection period was inferred for the site as a whole.

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CHAPTER 13

Prehistoric Ceramic Analysis, Technology and Style

S. Terry Childs

Introduction

Overview of Analysis Methodology

The analysis of the Cape Cod ceramic materials involved two phases. The first phase documented all of the sherds for each provenience in a concentration in terms of decoration, surface treatment and technology. The second phase divided groups of sherds into vessel lots and characterized each vessel at a site by rigorous morphological, decorative and technological criteria.

The first level of differentiating the pottery sherds was according to temper, the purposefully added non-plastic inclusions in the clay paste. The basic types of temper used at the sites analyzed here include: grit or stone, shell and a mixture of grit and shell or organics. A careful examination of the stone inclusions in the mixed temper category was performed to determine grain angularity. This related to the extent to which the rock used as temper was purposefully broken up. Rounded sand particles which were not present in a large quantity were assumed to be natural to the clay. Within each temper type the total sherds from a provenience and each vessel lot from a concentration were counted and analyzed in terms of a number of specific attributes.

The purpose of the first analytical phase was to record systematically all the ceramic material excavated, including the very small pieces. The generalized attribute analysis of this material provided basic data for a variety of comparisons as well as a basis with which to delineate vessel lots.

The major attribute categories employed in this first analytical phase were decorative technique, interior and exterior surface treatment, plus technological and functional criteria. These are presented in greater detail below.

The second stage of analysis involved only those sherds that could be assigned to unique vessel lots. These lots were examined further to provide more specific and comprehensive data for investigating the functional, technological, temporal and spatial variability of the pottery made and used by prehistoric peoples on outer Cape Cod. The purpose of the second phase was not to document every excavated sherd, so only those sherds which can be differentiated by specific criteria were used. Most of the spalled sherds and the fragments smaller than a square centimeter, therefore, were not incorporated into the analysis although all sherds were carefully examined.

Since so few rim sherds were found at the sites, unique vessel lots were determined during the second analytical phase by similarities in: (1) surface treatment and decoration on both surfaces, (2) the kind, size and density of tempering materials and natural inclusions and (3) the color, texture and hardness of the paste. All vessel lots designated are unique in at least three of the specific attributes listed above.

Acknowledging that several methods of surface treatment and decorative techniques could be employed on one vessel, careful attention was given to the search for multiple techniques present on large sherds. Attention also was paid to those sherds that were similar in other attributes like temper type, density and size. Within each general category of temper, grit or shell, specific types of stone (granite, mica, feldspars and quartz) or shell (scallop, quahog, or soft shell clam) were examined. When the tempering materials could be identified, the density of inclusions and the size range to which the temper was crushed could be assessed, and the determinations of vessel lots simplified. Examination of some of the local clays showed the frequent presence of small, rounded, iron-enriched modules of clay material. The presence, size, range, and density of these natural inclusions also helped to distinguish between vessel lots.

The possibility of a wide variability in surface color on one vessel due to firing, functional and post-depositional factors made color less useful in distinguishing lots, although permissible in conjunction with the other criteria presented above. Since paste texture is a somewhat subjective attribute and is affected by post-depositional processes, it was less useful than other criteria for determining vessel lots.

The Analysis of Sherds

In the first stage of analysis, the very fragmented nature of many sherds made the discernment of decoration difficult or impossible. Ten categories of decorative types were used to cover the range known to occur in New England. These included: dentate, rocker dentate, complex dentate, punctate, incised, fabric impressed, scallop impressed, combed, cord-wrapped stick

and a catch-all for odd types called "other". Another category called "not determined" was employed when decoration was present but not identifiable. No attempt was made to determine decorative motifs in this phase since most individual sherds were too small to permit identification of any patterns.

Totals of rim and body sherds for decorated, cord-marked, undecorated and spalled pieces were counted so relative proportions of these categories could be determined. Cord-marked and decorated sherds were distinguished for a technological reason: the cord-marking results from patting the vessel surface with a textile-covered paddle to even out and thin the walls during vessel construction. The presence of a fabric pattern on the surface might result more from technological necessity than decorative preference. Spalled sherds were very prevalent and counted separately; since their exterior surfaces were broken off longitudinally, decoration, if it existed, could not be identified.

Surface treatment was another attribute recorded during the first analytical phase. It aimed to discern the processes used to form the vessel prior to decoration. Occurrences of smoothing, wiping, and scraping of the interior and exterior surfaces were tabulated. These attributes provided clues to vessel wall construction, functional properties, and its preparation to receive decoration. Again, spalling and weathering often made the determination of the surface treatment impossible.

Other technological and functional attributes recorded in the first phase were the numbers of sherds with coil breaks or an organic residue. The former relatess to hypotheses of construction methods, vessel durability, and properties of the raw materials used. The latter attribute provides insights into vessel functions. Additional chemical or physical analysis of the carbonized material may determine what substances were prepared in the vessels.

The Analysis of Vessel Lots

The attribute analysis was conducted on each vessel lot as a single unit so that the value selected to describe a particular attribute for each lot encompasses the vessel's total range of variation. For example, vessel morphology takes into account all the portions of a vessel represented by the sherds in a vessel lot. Similarly, exterior surface treatment can include several techniques such as smoothing and scraping.

The types of attributes selected for vessel lot analysis can be grouped as:

(1) morphological, including vessel morphology, vessel mouth diameter, rim angle, lip and rim profile;

(2) decorative, including the location of the decoration on the vessel, technique, motif and some of the particulars of the decorative techniques such as punctate shape, the direction in which a cord is twisted and the method of applying a cord-wrapped stick to a plastic vessel surface;

(3) technological, including interior and exterior surface treatment, technique of manufacture, specific temper inclusions, minimum and maximum temper sizes, temper density, paste texture, minimum and maximum thicknesses of the body wall, the rim and the vessel lip, and the number of coil breaks; and

(4) functional, including the presence and location of carbonized residue.

For the most part, the values listed for each attribute in the vessel lot phase of analysis are self-explanatory (Table 13.1).

The decorative motif was determined by using all the sherds in a vessel lot and fitting pieces together whenever possible. Unfortunately, it could be determined for relatively few vessel lots. Three reasons for this can be suggested: (1) the small size and number of sherds in many vessel lots, (2) the low frequency of rim sherds where decoration might be concentrated, and (3) a small repertoire of motifs used by the prehistoric groups over time. The traditional approach to analysis of decorative motif in ceramic studies has been to trace variations in particular patterns over time and particularly space in order to develop models of cultural transmission or to identify culture groups. Additional, different kinds of questions need to be asked of this material, however, such as:

(1) Why is there a seeming increased or decreased use of different motifs at different points in time or space?

(2) Are different temporally consistent motifs executed with different techniques and why?

(3) Are there functional or ideological reasons for a change between cord-marked vessels and those decorated by other techniques?

(4) Do the decorative motifs have any significance within communication spheres of the prehistoric social system (Wobst 1977)?

Minimum and maximum values for temper size and wall thicknesses were recorded because the range of variation can be considerable within one vessel and can be very significant technologically. The degree of uniformity in the vessel wall should reflect the type of construction technique (e.g., pinching out the rim), the extent of care taken during construction and the amount of concern for mechanical/functional benefits. Uniform heating, for example, would result from uniform vessel walls for optimal cooking and minimal stress on the vessel itself.

Another attribute included in the vessel lot analysis was the number of coil breaks per vessel. Within a lot, each coil break was counted, up to two per sherd. This was done to determine the minimum extent to which fracturing occurred along coil weaknesses within a vessel lot.

TABLE 13.1

Values Used for 1981-1982 Analysis of Pottery Vessel Lots

Vessel Morphology

1. Lip, rim, neck, shoulder, body
2. Lip, rim, neck, shoulder
3. Lip, rim, neck
4. Lip, rim
5. Lip
6. Rim, neck, shoulder, body
7. Rim, neck, shoulder
8. Rim, neck
9. Rim, shoulder
10. Rim, body
11. Rim
12. Neck, shoulder, body
13. Neck, shoulder
14. Neck, body
15. Neck
16. Shoulder, body
17. Body
18. Base
19. Pipe bowl
20. Pipe stem
21. Unknown due to weathering, spalling, or sherd size and shape
22. Lip, rim, body
23. Lip, body

Location of Decoration

1-23. same as for Vessel Morphology
24. undecorated
25. spalled

Interior Surface Treatment

1. Smoothed
2. Wiped
3. Scraped
4. Smoothed, wiped
5. Smoothed, scraped
6. Wiped, scraped
7. Not distinguishable due to spalling and weathering
8. Cord-marked

Exterior Surface Treatment

1. Smoothed
2. Wiped
3. Scraped
4. Smoothed, wiped
5. Smoothed, scraped
6. Wiped, scraped
7. Not distinguishable
8. Cord-marked
9. Cord-marked, smoothed

Decorative Technique

1. Undecorated
2. Dentate
3. Punctate
4. Incised
5. Fabric impressed
6. Scallop impressed
7. Combed
8. Cord-wrapped stick
9. Pseudo scallop
10. Incised and punctate
11. Dentate and incised
12. Cord-marked
13. Stamp and drag
14. Undetermined
15. Incised, punctate & cord-wrapped stick
16. Multiple dentate forms applied simultaneously with rocker dentate stamp over it.
17. Cord-marked, incising
18. Combed and dentate
19. Cord-marked, punctate
20. Incised and scallop impressed

Decorative Motif

1. Undecorated
2. Horizontal parallel rows
3. Vertical parallel rows
4. Diagonal parallel rows
5. Triangle
6. Chevron
7. Herringbone-multiple layers
8. Rocker stamped
9. Can't tell
10. Chevron incisions on rim with deep punctate underneath followed by horizontal rows of cord-wrapped stick.
11. Diagonal rows bordered on the top by a horizontal row
12. Series of triangles inside one another
13. Vertical rows with diagonal rows in bet
14. Cross hatch
15. Wavy parallel lines
16. Sets of 2 horizontal parallel rows with wide spacing between the sets
17. Rows perpendicular to each other
18. Sets of 5 horizontal parallel rows with wide spacing between sets
19. Rows perpendicular to each other around a broad
20. Horizontal parallel rows above rocker stamped region

Type of Punctate Shape

1. Ring
2. Oval
3. Crescent
4. Slit
5. Rectanguloid
6. Irregular
7. Round
8. Basin-deep, round
9. Triangular

Type of Cord Twist

1. Unknown
2. S-twist
3. Z-twist

Method of Applying Cord-Wrapped Stick

1. Unknown
2. Rolled
3. Repeated simple impressions

Technique of Manufacture

1. Unknown
2. Coil (unknown bonding technique)
3. Coil, then bonded by paddle and anvil
4. Finger bonded coils
5. Hand pinched from a block of clay

Temper

1. Angular
2. Pebbly quartz
3. Mica
4. Feldspar (rounded)
5. Granite (crushed; pink feldspar grains or whitish matrix with dark phenocysts
6. Grog
7. Shell
8. Angular quartz, crushed granite, mica pieces
9. Pebbly quartz, crushed granite
10. Sand (quartz, feldspar grains)
11. Angular quartz, crushed granite
12. Crushed granite, sand
13. Shell, angular quartz
14. Untempered
15. Shell, angular quartz, rounded sand
16. Angular quartz, mica
17. Shell, granite
18. Angular quartz, granite organics
19. Crushed granite, mica pieces

Maximum and Minimum Temper Size

(Shepard 1965: (18)

1. 64-4
2. 4-2
3. 2-1
4. 1-$\frac{1}{2}$
5. $\frac{1}{2}$-$\frac{1}{4}$

Types of Shell Temper

1. Unknown
2. Leached/Disintegrated
3. Scallop
4. Quahog
5. Softshell
6. Leached/Disintegrated with scallop impressions
7. Quahog, softshell
8. Leached with scallop and quahog impressions

Temper and Density

1. Light - very intermittent pieces of temper, 25%
2. Medium - 25-50% of cross-section is temper
3. Heavy - 50% of cross-section is temper

Paste Texture

(Shepard 1965: 117-120)

1. Crumbly - very low fired so that the material crumbles or disintegrates easily.
2. Compact - tightly compacted, small grains: small, homogeneous temper inclusions.
3. Porous - large pores in the body (not applicable to vessels with leached shell)
4. Fine porous - small, uniform pores in the body.
5. Coarse - large, heterogeneous inclusions in a compact clay body.

Presence of Residue

1. Absent
2. On exterior
3. On interior
4. On both sides
5. On lip

Lip Profile

1. Rounded
2. Squared
3. Pointed (rounded
4. Notched
5. Exterior and interior lip or overhand
6. Inside angle
7. Tapered, flat top
8. Exterior angled

Continuous Valve Attributes Recorded

1. Maximum body wall thickness (mm)
2. Minimum body wall thickness (mm)
3. Maximum rim thickness (mm)
4. Minimum rim thickness (mm)
5. Maximum lip thickness (mm)
6. Minimum lip thickness (mm)

Continuous Valve Attributes Recorded

7. Vessel mouth diameter
8. Rim angle (rim to lip) in degrees
9. Number of coil breaks on the sherds
10. Total weight of vessel lot sherds

Biases

Several potential biases must be mentioned prior to the main discussion. The primary body of data to be presented here comes from the vessel lot stage of analysis. These are treated as minimum numbers of vessels for each site and concentration. They are assumed to be representative of the total vessel population unless otherwise indicated. The majority of sherds examined were less than two centimeters in size and 19% of all vessel lots were designated on the basis of a single sherd (Table 13.2). This occurred particularly when one sherd with an atypical temper type for a concentration was present.

The counts of shell-tempered vessels might be artificially low compared to the grit and mixed tempered vessels since the shell-tempered sherds were not as easily separated into different vessel lots and were more frequent.

The sampling strategy of the site examinations posed another potential bias. Not only were excavated areas very limited at most sites, but the primary means used to determine the location of most excavation units was judgmental. Emphasis was placed on testing areas judged to have high artifact densities (see Chapter 2). The lack of more extensive sampling at most sites suggests that the representativeness of the vessel lot designations should be qualiified.

Finally, although all of the sites had been plowed or disturbed by other means, undisturbed middens and features were uncovered. The extent to which pottery is destroyed by plowing or even by such natural means as frost action and the extent to which mixing occurs between strata needs to be pursued further.

Pottery Density and Excavation Unit Size

There is another methodological issue which must be addressed here since it potentially could bias some of the interpretations derived from the vessel lot analysis. Since pottery is believed to have had a specific function as will be discussed below, it potentially can be used as an important indicator of prehistoric activities such as cooking. As an indicator of cooking, pottery might reflect the approximate locations of activity areas or refuse areas of domestic debris. Given these potential analytical uses of pottery, it is critical to examine how pottery is distributed over a site area and whether the different methods and techniques used for artifact recovery have provided an accurate reflection of the *in situ* pottery distribution and concentrations.

Relative to other artifact classes pottery sherds are not frequently recovered in the prehistoric site areas. This may be due to post-depositional destruction of pottery vessels and fragments from frost action, soil conditions, or historic period

and % of Vessels Identifications on Basis of # of Sherds

Site	# Vessels	# Concentrations with Vessels	1 sherd #	1 sherd %	2-5 #	2-5 %	6-10 #	6-10 %	11-20 #	11-20 %	21-30 #	21-30 %	31-40 #	31-40 %	41-51 #	41-51 %	51-100 #	51-100 %	100+ #	100+ %
19-BN-308	32	13	7	22	11	34	6	19	5	16			2	6			1	3		
19-BN-323	8	3	1	12	4	50	2	25					1	12						
19-BN-273/275	7	1	2	28	2	28			2	28	1	14								
19-BN-274/339	6	1	1	17	1	17			3	50							1	17		
19-BN-341	28	4	5	18	7	25	5	18	4	14	3	11					2	7	2	7
19-BN-288	14	11	2	14	8	57	2	14	2	14										
19-BN-390	11	3	1	9	4	36	4	36											2	18
19-BN-333	2	1	1	50					1	50										
19-BN-336	7	3	2	28	3	44	2	28												
19-BN-337	2	1	1	50			1	50												
19-BN-333/336/337	11		4	36	3	27	3	27	1	9										
19-BN-374	11	6[1]	3	27	5	45			3	27										
19-BN-471	7	ND	1	14			1	14	2	28	2	28	1	14						
19-BN-481	6	ND			3	50	1	17			1	17	1	17						
19-BN-410	1	1															1	100		
TOTALS	142		27	19	48	34	24	17	22	15	7	5	5	4			5	4	4	3

[1]Tentative number until all concentrations are delineated

ND No data

TABLE 13.2 Sherd frequencies used for the delineation of vessel lots by site

plowing. On the other hand, pottery vessels might not have been numerous during prehistory in comparison to other types of containers made with bark, grasses or reeds. When sherd fragments are found, they are often very small pieces recovered by hand trowelling or in the quarter-inch excavation screens.

The spatial distribution of prehistoric ceramics at four sites in the Nauset Bay area, 19BN274/339, 273/275, 341 and 308 (Foldout Map B) was examined closely with these points in mind. Considerations pursued below include:

(1) the spatial distribution pattern of sherds over a site,

(2) the relative presence/absence of sherds in the three types of test units dug for site examination (shovel tests, 50x50 cm excavation units, and excavation units of one square meter or larger), and

(3) the distance around a large excavation unit containing pottery or a pottery concentration within which sherds might be expected to occur.

The presence of pottery also was examined in relation to the high/low density of other artifact types over a site. The particular sites were chosen for this analysis because of the variety and distribution of the types of test units used during site exam and the variety of sizes and artifact densities within their concentrations.

Pottery is not found frequently in any of the three types of test units when the units with pottery are compared with all the units dug in the concentration areas (Table 13.3) or over the whole site area (Table 13.4). The presence of pottery is strongly associated, however, with the 1x1m or larger excavation units. Within concentrations, from nearly 50 to 100% of these units contain pottery sherds, especially when the units with pottery are compared to all the units dug that contained pottery (Table 13.3). More importantly, this is true when units with pottery are compared to the total number of larger excavation units dug within the concentration boundaries or over the entire site area (Table 13.4).

The 50x50 cm excavation units have volumes that are slightly larger than the average shovel test. Therefore, both test unit types are expected to have similar percentages containing pottery. The percentage of small excavation units with pottery in relation to total units dug or to total small excavation units dug is somewhat higher than the same percentages for shovel tests. These percentages, however, are considerably lower than for the large excavation units. These observations must be considered along with the fact that the small excavation units were more carefully dug than the shovel tests. Also, many fewer were dug than the other two types of test units. In general, shovel tests and the small excavation units are similar regarding the presence of pottery. Therefore, they will be grouped together in some of the analyses presented below.

TABLE 13.3

Site	TOTAL UNITS			TYPE OF UNIT											
				Large EU				50 x 50				STP			
	Total #	Total # w/P	% Total w/P	#	# w/P	% w/P	% w/P of Total units w/P	#	# w/P	% w/P	% w/P of Total units w/P	#	# w/P	% w/P	% w/P of Total units w/P
273/275	35	3	9%	2	2	100%	67%	3	1	33%	33%	0	0	0%	0%
274/339	4	11	23%	21	10	48%	91%	2	0	0%	0%	26	1	4%	9%
341	53	23	43%	11	11	100%	48%	12	6	50%	26%	30	6	20%	26%
308	222	47	21%	23	23	100%	42%	4	2	50%	11%	95	22	11%	47%

NOTE: Only units within concentrations are counted.

TABLE 13.3

Site	TOTAL UNITS			TYPE OF UNIT								
				Large EU			50 x 50			STP		
	Total #	Total # w/P	% Total w/P	#	# w/P	% w/P	#	# w/P	% w/P	#	# w/P	% w/P
273/275	53	3	6%	2	2	100%	3	1	33%	53	0	0%
274/339	71	11	16%	21	10	48%	2	0	0%	48	1	2%
341	89	23	26%	11	11	100%	12	6	50%	66	6	9%
308	401	47	12%	25	23	92%	5	2	40%	371	22	6%

NOTE: All units within each site area are counted.

The above results (Tables 13.3 and 13.4) document a strong association of pottery with large excavation units which, in turn, might indicate that pottery clusters spatially in the areas tested by these units. The large excavation units were placed judgmentally in areas of high artifact frequency as indicated by the shovel test grids. It is in these areas where pottery might be expected to be found. Before concluding that a legitimate association exists between the occurrence of pottery and high density deposits of artifacts and other remains, however, the bias of test unit size and the effect of test unit placement within high artifact density areas on pottery recovery were examined.

The spatial association of the different test unit sizes over a site and whether or not they contain pottery was of initial interest. The incidences of shovel tests and small excavation units situated either less than three meters away from or within 3-15 meters of a large excavation unit containing pottery first was compared (Table 13.5). When the few cases of small test units located within three meters of a large excavation unit that contained pottery were added up for all four sites, it is evident that these units, in the majority of cases, do not reflect the presence of pottery in the immediate area. For those small test units within 3-15 meters of a large excavation unit containing pottery, there is only a small percentage of cases in which pottery was recovered. Also, at all four sites, there are no cases of small test units that contain pottery within 15 meters of a shovel test containing pottery. All of the above observations, then, strongly suggest that shovel test pits and the 50x50 cm excavation units probably do not fully reflect the presence of pottery in the ground <u>except</u> within high artifact density areas.

It is possible that the strong association of pottery with high artifact density areas might permit predictions concerning activity area types over a prehistoric site area on the basis of relatively little excavation. To test this association, the percentages of shovel tests and large excavation units that contain pottery among those test units that have high shell and fire-cracked rock densities were calculated. A minimum weight of 318g of shell per quarter cubic meter of soil was chosen to indicate high density shell (see Chapter 9 for a discussion of high vs. low densities of archeological remains). The presence of fire-cracked rock in any amount was considered indicative of a nearby hearth with possible cooking associations.

It is evident in Table 13.6 that there is a strong association between the presence of pottery in shovel tests with both high density shell and fire-cracked rock. Although the large excavation units with high density shell and/or fire-cracked rock virtually always contain pottery, it is interesting to note that the presence of fire-cracked rock along with the shell has a higher frequency of association with pottery than those units with only high density shell. For both the

TABLE 13.5

Site	# of STP's w/P within 3 m. of EU w/P	# of STP's w/o P within 3 m. of EU w/P	# & % of small test units w/o P within 3-15 m. of EU w/P			# & % of small test units w/P within 3-15 m. of EU w/P			# & % of small test units w/o P within 3-15 m. of STP w/P		
			Total #	# w/P	% w/P	Total #	# w/P	% w/P	Total #	# w/P	% w/P
273/275	1	0	8	8	100%	8	0	0%	5	5	100%
274/339	0	1	15	15	100%	15	0	0%	5	5	100%
341	1	2	20	18	90%	20	2	10%	11	11	100%
308	6	3	51	48	94%	51	3	6%	41	41	100%
	8 (57%)	6 (43%)									

Table 13.6

Figure 3. Associations of high shell (HS)* and fire cracked rock (FCR) densities in shovel test pits (STPs) and excavation units (EUs) with the presence of pottery. (P)

Site	% STPs w/ pottery of STPs + no fcr	% STPs w/ pottery of STPs >318 gm S + fcr	% STPs w/ pottery <318 gm S no fcr	% EUs w/ pottery of EUs >318 gm S no fcr	% EUs s/ pottery >318 gm S fcr	% EUs w/ pottery <318 gm S fcr
19 BN 273/275	$0/3^{0}$	$0/0^{0}$	$0/2^{0}$	$0/0^{0}$	$1/1^{100}$	$1/1^{100}$
BN 274/339	$0/2^{0}$	$1/1^{100}$	$0/3^{0}$	$2/2^{100}$	$4/4^{100}$	$5/6^{83.3}$
BN 341	$0/2^{0}$	$1/1^{100}$	$3/6^{50}$	$2/2^{100}$	$4/4^{100}$	$9/11^{81.8}$
BN 308	$14/51^{27}$	$7/12^{58.3}$	$0/9^{0}$	$7/7^{100}$	$13/13^{100}$	$6/6^{100}$

* HS = high shell density = 318g/.25 cubic meter

shovel tests and the larger excavation units, then, the occurrence of both high density shell and fire-cracked rock virtually assures the presence of pottery. Pottery is not found as frequently in test units with a low density of shell plus fire-cracked rock.

In sum, the above tests and their results suggest several things:

(1) pottery is not prevalent on the prehistoric sites in the Nauset region of outer Cape Cod,

(2) pottery is more likely to be found in large excavation units than in shovel test pits or the 50x50 cm excavation units,

(3) pottery seems to be quite localized in its distribution and is associated with high artifact density areas, and

(4) therefore, pottery might function as a useful indicator of specific types of dense archeological deposits.

Ceramic Technology

The production and use of pottery is a dynamic process interactive with and affected by the cultural and environmental conditions of a society. These relationships can be examined through the study of ceramic technology, a theoretical and methodological perspective combining ceramic ecology (Matson 1965; Rice 1976) with analytical methods and considerations derived from ceramic engineering. The latter are used to examine the physical and mechanical attributes of the manufactured pottery while ceramic ecology focuses upon the resources and technology available to local potters given the economic, social, and natural constraints under which they must operate.

This section departs from the methodological issues presented above to consider the direct relationships between the pottery manufacturers, their resources and their culture. The section is organized according to common stages in the production and use of pottery, including: raw material procurement, raw material preparation, forming, drying, firing, use and recycle/discard. The physical and mechanical attributes of the pottery sherds recovered from archeological contexts potentially offer many insights into the decisions made and procedures performed at each stage. In the discussion below, particular mechanical and physical attributes and their implications will be considered under the appropriate production stage. In addition, ethnohistorical, experimental and archeological data will help to infer the specifics of prehistoric pottery production and use on the outer Cape. In combination, these data will offer a new perspective for exploring the behavioral and ecological aspects of ceramic techhnology.

Three types of nonplastic inclusions or temper material traditionally have been recognized in prehistoric pottery of the

Northeast: grit, shell, and mixed grit and shell. These types are represented among the sherds recovered by the survey (Childs 1982). The use of "temper" versus "nonplastic inclusion" has inspired a considerable amount of discussion in the archeological literature (Arnold 1974; Shepard 1965; Matson 1965; Rye 1981) and should be defined here. Ceramic technologists advocate the use of "nonplastic inclusion" to refer to the non-clay materials purposely added to a clay paste during pottery manufacture. The use of "temper", on the other hand, often is not differentiated as being a natural inclusion or intentionally added. In this report, the term "temper" is used to mean purposefully added nonplastic inclusions. It is preferred to the latter term for reasons of convenience, for example when referring to a "grit-tempered vessel."

It is assumed here that prehistoric potters, after years of observation, more or less tailored the production process to the eventual type and function of a vesssel (Braun 1983). In the Northeast, there does not seem to be a diversity of vessel types and, therefore, the ceramic technology is expected to be relatively simple. "In no instance, however, can the utilitarian Woodland vessel in either the Midwest or the Northeast be considered as anything other than cooking containers" (Braun 1980:96). Both ethnohistoric and archeological data support Braun on this point. Ethnohistoric evidence from southeastern Massachusetts suggests that among the abundant forms of container vessels in use by the prehistoric peoples, pottery was infrequent. A great variety of vessel types were made out of wood, reeds, grasses, and bark for a multitude of functions while pottery seemed to be restricted to cooking (e.g. Mourt 1963:28). The archeological data from the outer Cape further support this finding since the vessel lots with all three types of nonplastic inclusions have carbonized residues, presumably the remains of cooked food, adhered to some sherds. The following discussion of the ceramic technology, then, will regard the pottery as functioning primarily in a cooking context.

There is an expanding literature devoted to experimental studies of pottery manufacture, function and failure especially as related to mechanical attributes (Braun 1980, 1983; Bronitsky 1982; Stimmell et al. 1982; Rye 1976, 1981; Shepard 1965). Although some of the experimental work lacks exact comparability to the prehistoric record in terms of the raw materials (e.g. the use of studio potter's clay), the experimental technology or testing vessel shape (e.g., using a long, thin tile instead of a pot for tests), the results have been stimulating. They will be discussed below under the appropriate stage of pottery production.

Resource Selection

Prehistoric pottery making in the outer Cape Cod region was dependent upon two kinds of raw materials for the initial

formation process: clay and nonplastic inclusions. A third resource used later in the manufacturing process was fuel for firing the vessels. The preliminary resource selection and collection stage as with the other production stages was probably not a year-round activity. The season of the year could have presented serious constraints on the availability and the ability to manipulate the materials. These considerations are discussed below.

Clay is the primary constituent of a pottery vessel. The clay material on Cape Cod consists of clay, probably illite (Sideroff 1980:183), and silt paricles as well as other natural nonplastic inclusions, usually iron oxide nodules. This residual clay is glacial in origin and derived from the tiny particles settling to the bottom of glacial meltwater pools (Oldale 1979). Pockets of clay are visible along the eroding beach cliffs which presumably were as obvious and everchanging in prehistory as they are today. These clay beds vary in depth, breadth and stratigraphic complexity depending on the size and history of the ancient glacial meltwater pools. The density and type of nonplastic inclusions naturally occurring in the clay also vary by deposit and by stratum within a deposit. Thus, the prehistoric potters would have had varying amounts of clay visible and available depending upon the size of a deposit and the stability of the landform in which it occurred. One current well-known and extensive clay deposit on the outer Cape is located near Highland Light in North Truro (Moffett 1959), while several small deposits have been noted by Moffett (1949) on the bay side. At the present time, no extensive clay deposits have been noted in the Nauset Bay area although a systematic survey of the beach embankments has not been done.

No matter how visible or available a clay resource is, however, its attractiveness for mining and use is season and climate dependent. It is commonplace during clay selection for a potter to conduct simple workability, taste, smell, and color tests on a prospective clay (Arnold 1974; Mason 1982). If similar tests were performed by prehistoric potters on Cape Cod, their feasibility and effectiveness would have been seriously affected by outdoor temperature and dampness. It is likely that from about November until April frozen ground, ice, snow or dampness would have seriously hindered and perhaps curtailed clay selection and pottery manufacture.

The other raw material central to prehistoric pottery manufacture is nonplastic inclusion or temper purposefully added to the clay. The availability of these materials presumably was greater than the availiablity of clay and would not have been so seasonally restricted. For instance, the beaches abound with granite, quartz cobbles and sand for grit temper, and various species of shell for shell temper. A possible complication, however, might have occurred if a particular shell species was preferred as temper, but was not readily available at a site and had a seasonal or storm-related cycle of deposition on the

beaches. Scallop shell was a popular inclusion in the pottery of Cape Cod and the Islands and may have been irregularly or seasonally available. Of course, the potters may have collected and stored this resource for future use if its value and uncertain availability were significant to them. No ethnographic enderce is available to support any of these alternatives.

Unless a clay is naturally tempered, the addition of nonplastic inclusions is important to the manufacture and durability of pottery vessels in a number of ways. In general, nonplastic inclusions increase the workability of the clay so it has greater flexibility and strength, they increase porosity which promotes uniform drying and reduces the shrinkage stresses created during drying and firing, and they act as a binder to the clay for additional support in vessel construction.

The size, shape, density and distribution of the inclusions through the clay, however, can alter their effectiveness during the various stages of production and use. Fairly large particles are better for binding the clay and provide more porosity, but can increase the likelihood of fracture during heating and expansion. Smaller grains provide greater resistance to crack initiation and greater flexural strength to the vessel walls (Braun 1983:27). Irregularly shaped inclusions form stronger bonds with the clay for greater strength than rounded, smoothed grains. Long, flat, plate-like inclusions will be pushed into a parallel position to each other in which they potentially can act as reinforcers against cross-fracture. The density of the inclusions depends on the properties of the unaltered clay, but in general, the greater the density of inclusions, the weaker the vessel body. Vessel strength and porosity is also maximized with a uniform distribution of well- sorted grains. Other mechanical attributes of pottery vessels during construction and use which are influenced by the nonplastic inclusions include: thermal expansion, thermal shock, crack propagation and shatter resistance. These properties along with specific observations on the properties mentioned above will be discussed further in relation to each type of nonplastic inclusion used on the outer Cape.

Some of the types of stone used as "grit temper" in the prehistoric pottery of the Cape include quartz, granite, mica, and sand in various combinations. Each of these materials has particular or unique properties. In general, however, the advantages to using grit inclusions is their availability, their potential benfit as a binder to the clay, and their ability to create pores in the clay which promote uniform drying and provide numerous dead-ends to curtail cracks from expanding and lengthening. The principal disadvantage as a group is that minerals have higher thermal expansion rates than clays. This means that during firing and possibly cooking, the greater volumetric expansion of the minerals will initiate the production of cracks in the clay and the possible breakdown of a vessel.

Some properties of the specific types of stone are important to vessel forming and firing characteristics. Quartz not only has a high rate of thermal expansion, but undergoes several thermal inversions at specific temperatures. These inversions result in volume changes which promote cracking. One way to counter some of this effect is to use very small quartz grains. The use of smaller quartz grains, such as are found in sand, is potentially detrimental to a vessel's structure and strength, however, since the smooth, round grains in sand do not provide good binding surfaces. Finally, a well-fired pot tempered with quartz must be fired to high, uniformly distributed temperatures (Bronitsky 1982), a process requiring good control over the fire and large amounts of fuel.

The particular characteristics of granite used in the prehistoric pottery are its large grain size and its higher rate of thermal expansion than clay. The platey structure of mica potentially reinforces and strengthens vessel walls against fractures when the plates are aligned parallel. Thinner walls might be a side benefit to the use of mica as a result of these attributes.

The types of shell identified as nonplastic inclusions in the pottery from the Cape include scallop, quahog and softshell clam. Other species may have been used but were not identified due to small fragment size and the high proportion of the sherds with leached or disintegrated shell. The overall advantages to using shell as a temper are: (1) its availability, (2) the relative ease of crushing it, (3) its irregular shapes, offering a potentially good binder with clay and (4) its platey, thin form that permits a parallel alignment for greater fracture resistance, wall strength and thinner walls. Most importantly, shell or calcium carbonate has a very similar rate of thermal expansion with clay so no stresses are produced during firing.

The principal disadvantage to using shell as a tempering material in pottery vessels, however, is the irreversible chemical reaction of calcium carbonate ($CaCO_3$) decomposing into calcium oxide (CaO) and carbon dioxide gas at temperatures as low as 620 degrees C. The reaction speeds up with increased temperatures. The CaO which is formed readily combines with water and in the process expands volumetrically. This sets up pressures that can result in the total disintegration of a pottery vessel (Rye 1976). Experiments by Rye (1976, 1981) and Stimmell et al. (1982) show that the addition of salt either in crystalline form or in sea water inhibits the initial decomposition reaction at lower temperatures and increases the probability of vessel survival during firing and extended use. As Rye points out, any excavated sherd represents the minimally successful combination of raw materials and firing procedures since complete disintegraton did not occur (Rye 1976:135).

The specific species of shell most frequently noted in the pottery sherds excavated in the Nauset areea is scallop. Its

unique form may have biased the frequency of observation yet it does have several advantages that might have made it more suitable for pottery making. Its relatively thin, friable walls would make it easier to crush than, for example, quahog and its ridged surface provides a better bond to the clay than smooth-walled shell.

A mixed temper of grit and shell is also occurs, though infrequently, in the prehistoric pottery of the Cape. Angular quartz, sand and granite are found with scallop and other kinds of shell. Most often the shell has leached out so that scallop impressions are the only clue to species. A mixed temper presents a combination of the advantages and disadvantages of shell and grit.

The final raw material used in pottery production is the fuel for firing the pots. This material would have been collected just prior to a firing and some time after the formation and drying of the vessels. An open fire, capable of reaching a maximum temperature of 900 degrees C, will operate with wood, brush, grasses or the like. It is not known what the prehistoric potters used. Given the probable temporary nature of pottery-firing facilities, it is extremely unlikely that an area where pots were once fired will be found, recognized and excavated. The collection of appropriate firing material could occur year-round yet it is unlikely that pots could easily be dried sufficiently to fire in the late fall through early spring months.

Resource Preparation

Once a raw material is selected and collected by a potter, it is often prepared in some way to enhance its effectiveness for a later stage in manufacture and use (Rye 1981). Clay can be treated by several simple methods, but if it is basically workable and plastic such as the residual clays on Cape Cod, little further action needs to be taken. The natural inclusions of iron oxide nodules in various sizes and amounts as are in the Cape clays, however, potentially can be detrimental to the production of a strong, well-fired vessel. A pot with uniform grain size and grain distribution will resist crack initiation better and, therefore, will benefit from the effort expended to sort out large inclusions from the clay. The purposeful exclusion of iron oxide nodules from the mined clay also benefits a vessel's durability since the thermal stresses created by their high rate of thermal expansion would be countered. The evidence from the excavated sherds, though, suggests that refinement of the clay did not occur. In numerous cases many large nodules were present in the fired pot sherds.

It is also common among potters of various cultures to crumble up and dry out the mined clay in order to facilitate refining its natural inclusions and to control the addition of

water while reconstituting it. As discussed above, the presence of salt in shell-tempered pottery inhibits destructive reactions during firing. The prehistoric potters could have added salt water to dried clay to take advantage of this benefit when using shell additives. It is also possible, however, that by collecting their clay from eroding cliffs along the beach, the potters retrieved clays naturally exposed to and saturated with salt. In this case, the potter might have been unaware of the benefits nature provided. Experimental work with unaltered clay and reconstituted clay with salt water both tempered with shell must be performed before further comments can be made.

Most of the types of purposely added inclusions were altered prior to their addition to the clay except for the occasional use of beach sand. Quartz and granite cobbles were crushed to produce angular fragments which varied considerably in size. The method of crushing is unknown yet there is the possibility that the cobbles were fire-cracked, then crushed.

Although Eteson et al. (1978:22) observed the presence of burned, crushed granite in some of the sherds of the Mattaquason Purchase site, this attribute could not be definitely distinguished in the survey sherds. The most obvious attribute of the grit inclusions in these sherds, though, is the wide range of sizes suggesting that little sorting was done by the prehistoric potters. The shell used as nonplastic inclusions also had to be crushed thereby producing angular fragments. Byers and Johnson (1940) noted that the shell inclusions in the pottery from Martha's Vineyard seemed burned most likely prior to crushing. Burning the shell offers several potential advantages:

(1) increasing the friability of the shell for ease in crushing,

(2) burned shell better resists crack initiation, shatter from outside forces, and thermal shock than either unburned shell or sand (Bronitsky 1982),

(3) cracking and spalling resulting from calcium carbonate decomposition and calcium hydroxide expansion during vessel firing is minimized since the irreversible reactions would already have transpired (Bronitsky 1982), and

(4) it is possible that vessels' walls are strengthened from a cementation process resulting from the hydration of burned or partially burned shell (Bronitsky 1982).

Although some of the shell temper seen in the pottery from the Nauset Bay area seemed to be burned, no comparative tests such as those done by Byers and Johnson (1940) have been conducted to check on this possibility.

The final preparatory step prior to vessel formation is the addition of the nonplastic inclusions to the clay. This involves careful mixing and wedging in order to get a uniform distribution of the inclusions and to remove unnecessary air pockets from the clay paste.

Forming

The formation of a pottery vessel involves several considerations including the season and climate, the forming techniques known to the potters and the shape of the desired vessel. It is difficult to manipulate the clay during very cold weather because of the reduction of clay workabililty and plasticity. Seasonal availability of fuels and the presence of high winds might be other limitations to pottery firing. It is likely, then, that vessel formation and firing generally occurred during the spring to the late fall months unless immediate need necessitated the production of a pot during the less optimal months.

The size, shape and wall thickness of a prospective vessel can influence the formation technique used. The simple vessel forms from the New England region vary somewhat over time but primarily in terms of the roundness of the body, the conical base and the presence or absence of a neck. Indications from the archeological record suggest that the primary technique used by the prehistoric potters to form these basic vessel shapes was coiling strips of rolled clay in a spiral fashion or building up loops one on top of the other. The thickness of the coils can vary depending upon the desired wall thickness and height and the care and amount of work performed.

A fairly high proportion of excavated sherds, representing all three of the temper types, have evidence of breaking along a coil juncture. In some cases, the sherds reveal the actual coil thickness, probably after some compression, which usually varies between five and twelve millimeters. In general, the more plastic the clay, the thinner the coils produced (Shepard 1965:58). The strength of the vessel walls, however, depends on the bonding between the coils. This involves compression to form contacts and overlapping the coils to form a strong bond. Coil breaks indicate the extent and form of the bond: (1) vertical placement and compression of the coils together produce slightly concave/convex junctures which have less bonding contact and are weaker than, (2) overlapping the coils to produce a wide, tapered junction. Both of these types of break patterns are present on the prehistoric Cape Cod sherds. Another potential factor in the separation of the coils, however, is the dryness of the clay (Rye 1981:63) which may be influenced by the porosity of the clay paste, the weather and the speed of the potter during formation.

The initial step in the production of a coiled pot was either to form a base or slab from which the coils are built up or to begin construction at the neck by the coil method and once near the base of the pot, seal it off with a slab of clay. The typical conoidal or pointed shape of the base would have to have been maintained in some unknown way while the clay was still wet and plastic in the first hypothetical sequence but would have been built up from a clay mass in the second. Unfortunately,

there is insufficient archeological or ethnohistoric data from which to reconstruct sequence.

A secondary formation technique employed by the potters on Cape Cod was the use of the paddle and anvil. This involved placing a flat tool or hand on the inside of the damp vessel and paddling the exterior to increse the bonding contacts between the coils and to further thin the vessel walls. In order to prevent the paddle from sticking to the damp clay surface, material or cordage was wrapped around the paddle This produced impressions commonly referred to as cord malleations or cord markings which are prevalent on the prehistoric pottery of New England, in general, and on Cape Cod.

Some of the final formation steps just prior to setting a finished vessel to dry were:

(1) forming the rim and lip of the pot, which in many cases probably involved cutting off any uneveness along the top of the pot,

(2) smoothing out any rough portions of the surface and pushing large inclusions into the clay,

(3) applying any decoration that required the clay to be fairly plastic and

(4) thinning down the walls by scraping.

The end product was usually a fairly round- shaped vessel with thin, undulating walls depending on the extent to which the potter smoothed out the coils. The rounded vessel shape was optimal for cooking since no sharp angles were present to provide fracture loci under conditions of thermal stress and shock. Thin walls provide greater thermal conductivity permitting contents to be heated faster, but they have less resistance to flexural fracture and thermal shock.

Drying

Clay dries to two basic states on a continuum, the leather hard state and a drier condition ready for firing. The leather hard condition occurs when the clay is no longer plastic so will break under pressure, but is soft enough to be easily cut or to yield to a variety of decorative techniques. It is at this state that the final contour of a vessel's lip may be formed and such decorative techniques as incising, combing, rouletting and dentate or shell stamping might be applied. The crisp lines and impressions on the surfaces of many of the Cape Cod sherds suggest that the decoration was applied at the leather hard stage. A number of other sherds, however, have distortion or clay pushed up along the edges of the decorated area or element suggesting that the decorative work was performed on a less dried plastic clay surface.

The principal factor to control during the final drying stage is how uniformly a vessel is dried. Stresses and cracking will develop from uneven or inadequate drying. Conditions

internal and external to the vessel are important to consider in this light. Different clays dry at different rates given the same conditions and the purposeful addition of nonplastic inclusions further alters this drying rate. The internal structure of a clay body is changed with this addition by creating and increasing the number and size of the capillaries through which water travels to the wall surface and evaporates. The uniform distribution of inclusions results in a similar distribution of capillaries which, in turn, promotes proper drying if the vessel is evenly exposed to sun, warmth and air movement. If a vessel's walls become densely packed, however, through a forming technique such as the paddle and anvil, the benefits from the capillary action will be minimized (Rye 1976:112) and stress cracks can result.

Climate was probably a critical factor for drying pots made on the outer Cape. Several continuous days of sun and moderate heat are often necessary to be assured of a slow and evenly dried pot. Dampness, rain, snow, coldd, and extended periods of cloudy weather are not conducive to complete drying within an expedient time period. If any free water remains in a vessel's walls, the pot is likely to explode during firing from the extreme steam pressures rapidly built up from the heat.

The excavated sherds from the outer Cape are well tempered insuring uniform and complete drying under the appropriate weather conditions. The use of the paddle and anvil by the prehistoric potters may have somewhat decreased the porosity and capillary action in the vessels but the size and shape of the inclusions could have countered this potential problem. The extent and effect of this condition is unknown since severely cracked vessels would have been discarded prior to firing. Occasional vertical cracks were noted, however, on some of the larger grit-tempered rim sherds which may have been produced during drying.

Firing

The prehistoric pottery from Cape Cod was most likely fired in the open such that the pots and the fuel were in intimate contact and no structure surrounded the materials. The absence of a kiln, however, does not necessarily mean an absence of control and skill in the firing process. Temperature, atmosphere and firing rate must be at least partially controlled to insure the transformation of the clay minerals into hard, crystalline structures that are durable under use. The location of the firing area, the types of fuels used, the stacking of the fuel and vessels and the observational abilities of the potter all have direct influence on the firing outcome.

Although the types of fuel selected by the prehistoric potters and their method of stacking the materials are unknown, some basic criteria had to be met to yield whole, fired pots.

Some of the sherd attributes provide further clues to the firing process. The choice of firing location is important since the prevailing winds can speed up or help complete combustion depending upon how the pots and fuel are stacked. To take adavantage of rising heat, some fuel is usually placed under the pots prior to lighting and as it is stacked around the vessels, gaps between the fuel are often left for air circulation. The pots must not be heated too rapidly, however, or pressures from trapped water or rapidly expanding inclusions can crack a vessel. The types of fuels used, the practice of preheating the vessels to evaporate trapped water and tight initial packing are ways to initiate slow and even burning when desired.

The maximum temperature achieved during a firing might need to be controlled for both quartz- and shell-tempered pottery. Higher temperatures are better for quartz-tempered pots since its refractory properties can inhibit clay sintering reactions. The thermal inversions and high thermal expansion rate of quartz, however, are detrimental to a pot's integrity as discussed above. Unless salt is added to a clay purposely tempered with unburned shell, firing to temperatures over 800 degrees C will cause the eventual disintegration of a vessel due to the reactions set up by calcium carbonate decomposition. An increase or decrease in temperature can be attained by the method of stacking the fuel espcially as related to the winds and the types of fuel selected.

The Cape Cod pots were undoubtedly fired in an either oxiding or neutral atmosphere where there is an excess of oxygen or carbon dioxide, respectively. The maintenance of a completely oxidizing atmosphere throughout a firing is difficult since the presence of carbonaceous material in a pot's matrix and the fuel itself give off abundant carbon monoxide, yet a reducing atmosphere is virtually impossible at temperatures under 900 degrees C. The presence of a dark core in the grit-tempered sherds from the Cape strongly suggests that organics were originally present in the clay and not completely burned out during firing (Rye 1981:115; Shepard 1965). This could be due to a short firing period, low temperatures or poor air circulation. Many of the shell-tempered sherds have a uniform color in their cross-section which suggests that the atmosphere was oxidizing and organics were either not present or were completely burned out of the clay over a sufficiently long firing period.

Many stresses are set up during firing: inclusion expansion or decomposition, too rapid heating or cooling, trapped water and incomplete drying. The visible manifestations of these conditions in or on the sherds are variously shaped cracks or spalls. The differential thermal expansion rate of quartz and granite fragments will cause "star-shaped cracks" (Rye 1981:111) radiating out from the inclusion. These are prevalent on the interior and exterior surfaces of the grit-tempered sherds from the Nauset area. Localized spalling will occur on the vessel surfaces tempered with shell when the calcium carbonate decomposes and reacts with water. Although this can lead to the

total disintegration of a vessel, the intact Cape Cod sherds showed evidence of only localized spalling. Cracks (Rye 1981:114) are usually found on vessel rims where too rapid cooling sets up tensions along areas of quick heat loss. These cracks were seen on several of the larger rim sherds suggesting that the pots were immediately removed from the fire and air cooled after reaching a temperature and condition deemed appropriate by the potter.

The specifics of the prehistoric firing practices on Cape Cod and their stability or change over time can only be minimally known unless some firing areas are identified and excavated. With a larger sample of sherds and their careful examination, however, significant insights into the firing process as a whole would be possible.

Use of Pottery

It is presumed that the prehistoric pots of Cape Cod were manufactured by members of each household who then immediately used their products. The life expectancy of a ceramic vessel depends on the skill and experience of the potter to adequately complete all of the stages discussed. Cooking pots which survive through the firing stage are continually abused during use through thermal shock from heating and cooling, strength degradation and external impact. Awareness of these stresses during pottery manufacture can lead to alterations or changes which are more conducive to a longer life and a lower frequency of replacement.

Many of the mechanical and physical characteristics of the different types of nonplastic inclusions as well as aspects of vessel morphology have been alluded to as they might relate to function. Thermal shock, thermal expansion, crack initiation and crack propagation are all mechanical considerations which are intimately related. They depend to a large extent on temper characteristics and affect the use life of a ceramic vessel. The high rate of thermal expansion for quartz and granite inclusions will set up numerous stresses under conditions of rapid heating. For instance, the expansion of the exterior wall surface and its constituents at a faster rate than the interior wall plus its reversal during cooling will propagate the formation of cracks. The presence of numerous, medium-sized inclusions, however, increases vessel porosity so that there is greater room for expansion and contraction and initiated cracks will quickly stop when they reach a void.

Among the evidence that Braun (1983) cites in his model of changes in food types and preparation techniques between the Archaic and Woodland periods is the significant decrease in the thermal expansion problem when shell is purposely added to clay. The similar rates of expansion of clay and shell greatly reduce the likelihood of crack production which is particularly useful

under cooking conditions such as intense boiling. The stresses from differential wall surface heating and cooling are still present, although the porosity produced from a moderately high density of inclusions will counter many of the problematic effects.

A vessel's wall strength will decrease over a period of time during which numerous repeated cycles of heating and cooling occur. The vast network of tiny cracks weakens the walls although it is possible that the infiltration of food materials into wall pores will provide some strength through bulk. Experiments by Bronitsky (1982) underscore the problem of strength degradation especially when sand and unburned shell are used as temper. He found that test tiles tempered with burned shell also undergo weakening after repeated cycles of thermal shock. However, burned shell temper provided such good initial strength prior to the firing/cooking cycles that the tiles' survival rates were higher with this temper.

Cooking practices invariably involve many instances when the vessels are subjected to impact stresses. The likelihood that a vessel will fracture easily is increased when it is heated and the walls are more brittle. Bronitsky's (1982) experiments show that burned shell temper provides twice the resistance to impact shatter offered by sand or unburned shell.

Final consideration must be given to the aspects of vessel morphology which influence function. Vessel walls with sharp angles to them such as carinated pots provide points of weakness easily subjected to breakdown from thermal expansion and shock. Rounded vessel bodies do not have these weak points and provide a uniform distribution of heat. Rapid thermal conductivity occurs in vessels with relatively thin, even walls although the stresses quickly built up in these walls may lead to fracture. Overall vessel size influences wall thickness since large vessels require thick walls for support during building so that a compromise between vessel size, wall thickness, and the desired speed of heat conductivity may have been sought by the prehistoric potters.

Recycle/Discard

The current body of data from Cape Cod and much of the New England coastline contains no evidence for the recycling of pottery. Some of the common ways pottery is recycled in different cultures include: (1) as tempering material in the manufacture of new pottery, (2) large sherds are used as base molds on which to build up pots and (3) as markers in various contexts. If pottery was not a prevalent item in the material culture at the prehistoric living areas of Cape Cod or was viewed as having a very limited function, we should not expect to find evidence of substantial recycling in the archeological record.

Patterns of pottery use and failure should lead to expectations of pottery discard. Since the primary function of the prehistoric Cape Cod pots was probably for cooking and the highest incidence of failure would have been during cooking-related activites, the most likely context for pottery recovery would be around a hearth. In fact, every concentration in the Nauset Bay area with high densities and spatial clusters of fire-cracked rock has pottery in close association. The other context in which pottery is expected at the Cape Cod sites is in refuse pits or middens derived from food processing or consumption activites. Little or no pottery has been recovered from the few small refuse pits excavated at the Nauset Bay sites; however, sherds are fairly common in the larger general middens.

Although pottery sherds are often found in middens, their frequency is not high in relation to other categories of recovered material culture such as lithic debris or sometimes, faunal remains. This observation helps support the hypothesis that pottery vessels were not common in the material assemblages of prehistoric Cape Cod (Childs 1982). The limited function to which pottery was put in the society meant that vessels were probably made only when required or when seasonally efficient. Consequently, it is expected that they have a low frequency in the archeological record and that their technological history would suggest an expeditious manufacturing tradition based on need. It also is possible, however, that the low frequency of pottery at the sites is related to post-depositional factors.

Ceramic Technology: Summary

The material presented in this section integrated the common stages of ceramic manufacture and use with the particular traditions inferred for the prehistoric potters of outer Cape Cod and coastal New England in general. Detailed consideration was given to the technical adavantages and repercussions of the numerous practices and decisions made by the potters during the manufacturing process. Some of the sherd characteristics discussed were based on tradition-bound behavior resulting from the potters' observations and experiences with the raw materials, formation techniques, weather, etc. Other characteristics, however, have been observed and discussed by ceramic engineers and technologists and probably would not have been considered by the prehistoric potters.

Decorative Attributes and Chronology

Although the technological aspects of Northeast prehistoric pottery have been given little attention until recently (Kenyon 1981; Luedtke 1983), the decorative or stylistic attributes have been extensively described. Throughout New England and New York

state, pottery types have been used as chronological markers to date sites. The stratigraphic position of differently decorated and tempered sherds in unplowed contexts and middens served as the initial basis from which a pottery chronology was devised (Fowler 1966; Ritchie and MacNeish 1949; Moffett 1957). Within the last 15-20 years the availabililty of absolute dating techniques such as C-14 have provided a means to verify the sequence of pottery style changes outlined for the New England area. The resulting temporal associations of the pottery styles now make them somewhat more reliable for dating sites without the availability of absolute dating techniques.

Some absolute dates have been recently received for sites excavated on outer Cape Cod and will be presented in Chapter 14 under the discussion of each site area. Dates from a series of sites excavated on nearby Martha's Vineyard (Ritchie 1969) also are available and some are associated with pottery. There are, in addition, a number of dates accumulating in the New England area in general that provide some context with which to evaluate pottery styles from undated sites (Table 13.7). We must be careful, however, with our application of these non-Cape Cod dates to the survey concentrations, since there may be considerable local variation in the initiation, fluorescence and continuity of specific decorative styles (Dincauze 1975, Luedtke 1980).

Given the general tendency for most excavated pottery sherds to be small and fragmented in New England, little emphasis has been placed on using design motifs and patterns for chronological sequences. Surface treatment or decorative technique has been the primary focus of study although the kinds of purposely added inclusions has also been considered diagnostic of time periods. Ritchie's (1980) extensive work in New York state has resulted in a typology and chronology which has been widely used for comparison at New England sites. Fowler (1966) and Dincauze (1975), to a lesser extent, have developed very general chronologies for the Massachusetts area. Moffett (1957) has devised the only chronology specifically for the Cape Cod region. All of these sources provide a base from which the expected temporal sequence of pottery styles on the outer Cape can be described.

Before considering the specific temporal affililations of the decorative techniques, however, it is important to consider the varying precision with which the combination of decorative technique, pattern/motif and temper type can inform us about the temporal placement of sites and concentrations. Styles of decoration have varying ranges of duration depending upon the purpose they serve within social, ideological or economic realms of cultural systems. It is expected that rapid stylistic change will occur on vessels that are destined for a mass market where buyers' whims can be capitalized on by a creative potter and where gross changes in motifs do not relate to communication of cultural affiliation (Wobst 1977). In situations of relative

Vinette I	Dentate/Rocker Stamp	Pseudo-Scallop	Incised	Cord Wrap Stick With Punctate	Exterior Cord Mark
Oberlander #2 (NY) 998±100 BC (Ritchie 1980)	Great Diamond Island(ME) AD 85±150 AD 115±130 (Hamilton & Yesner 1981)	Sand Point (ME) AD 50±100 (Bourque 1971	Grape Island (MA) AD 650±95? (Luedtke 1974	Winooski (VT AD 850±135 900±125 1065±130 (Petersen 1980	Vincent (MA) BC 100±80(shell temper) (Ritchie 1969)
Scaccia (NY) 870±68BC (Ritchie 1980)	Great Moshier Island (ME) AD 190±100 AD 200±110 (Hamilton & Yesner 1981)	Cottage (NY) AD 140±100 (Ritchie 1980)	Winooski (VT) AD 655±150 725±135 750±130 (Petersen 1980)	Hunneman (ME) AD 980±120 (Bourque 1971)	Cunningham (MA) AD 400±80 (Ritchie 1969)
Hunter (NY) 841±68BC (Ritchie 1980)	Eaton (ME) AD 260±100 (Bourque 1971)	Winooski (VT) AD 160±155 AD 170±130 (Petersen 1980)		Wiesentahl (ME) AD 1100±80 1170±80 (Bourque 1971)	Calf Island (MA) 410±110 AD (Luedtke 1980)
Morrow (NY) 630±100 BC 563±250 BC (Ritchie 1980)	Cunningham (MA) AD 400±80 (Ritchie 1969)	O'Neil (NY) AD 240±80 (Ritchie 1980)		Grindle (ME) AD 1130±80 (Snow 1970)	Grape Island (MA) AD 650-95 (Luedtke 1975
Petersen (MA) 590±105 BC (Ritchie 1969)	Calf Island (MA) AD 410±110 (Luedtke 1980)	Cap-a-l'Original (QUEB) AD 280±100 (Dumais, 1978)		Hornblower II (MA) AD 1160±80 (Ritchie 1969)	Cunningham (MA) AD 1150-80 (Ritchie 1969)
Pratt (MA) 520±120 BC 480±80 BC (Ritchie 1969)	Winooski (VT) AD 655±150 AD 725±135 AD 750±130 (Petersen 1980)			Vincent (MA) AD 1230±1100 (Ritchie 1969)	Hornblower II (MA) AD 1160±80 (Ritchie 1969)
Peterson (MA) 360±100 BC (Ritchie 1969)	Point Buisson (QUEB) AD 700 (Petersen 1980			Hornblower II (MA) 1380±80 (Ritchie 1969)	Vincent (MA) AD 1230±100 (Ritchie 1969)
	Fernald Point (ME) AD 845±70 (Senger et al. 1980)				Hornblower II (MA) AD 1380±80 (Ritchie 1969)
	Wiesentahl (ME) AD 860±105 (Bourque 1971)				Petersen (MA) AD 1565±90 (Ritchie 1969)
	Cunningham (MA) AD 150±80 (Ritchie 1969)				

TABLE 13.7: Carbon 14dates from sites with pottery decorated by various techniques

cultural stability, of household pottery manufacture when the potter and pot user are one person and with fairly low frequencies of pottery vessels made annually, it is expected that decorative styles will have much longer durations of use. Very localized decorative variation, however, might relate to a potter's or group's need to differentiate themselves.

Changes in the types of nonplastic inclusions purposely added to clay, which may relate to changes in diet and food preparation (Braun 1980, 1983), can crosscut particular decorative styles. If temper, decorative technique, decorative motif and another functionally related attribute such as wall thickness can be closely associated with absolute dataes in a region, a much more useful chronology can be derived.

It is critical, then, not to depend heavily on pottery attributes to date sites at a fine scale until a basic outline of a prehistoric culture's socio-political and economic system is carefully considered and as many attributes as possible are temporally related. The following outline is a very general examination of some of the decorative techniques, temper types and technological attributes that have been associated with the different prehistoric periods and which can be used loosely for the temporal placement of the outer Cape sites.

The Early Woodland period is associated with Vinette 1 or exterior and interior cordmarked, grit-tempered pottery. Fowler (1966:53) notes that other decorative elements such as incising and linear dentate stamping may have been used in association with the cordmarking towards the end of the Early Woodland. The approximately 650-year span of dates from sites with Vinette 1 associations (Table 13.7) clearly points to the Early Woodland period. The dates from Martha's Vineyard (the Peterson and Pratt sites) are at the more recent end of the list.

The Middle Woodland pottery attributes include a wide variety of decorative techniques such as linear dentate, rocker dentate, punctate, cord-wrapped stick and incising (Petersen 1980). Although not mentioned by Fowler or Moffett, the use of a segment of a large scallop shell to make wide, undulating lines also seems to be associated with this period. This differs from the pseudo-scallop technique listed on Table 13.7 which is defined as an attempt to reproduce the small, tight and interconnected line of half squares of a scallop line by use of another implement. All of the scallop impressions seen on the survey sherds seem to be made with real shells. It also is commonplace on the Cape that more than one decorative technique is applied to a vessel. It is clear from Table 13.7 that these techniques were definitely used in the Middle Woodland period, but some techniques are more discretely dated within the Middle Woodland than others which extend into the Late Woodland period. For example, rocker stamping and cord-wrapped stick with punctate are more discretely dated than the use of a cord-wrapped stick, linear dentate, incising and exterior cord marking. Although

Site	Vinette I	Dentate/ Rocker Stamp	Incised	Cord Wrapped Stick	Scallop impressed
Small's Swamp No. Truro	"Early Woodland" (grit)	"Early and Middle Woodland" (grit)	"Late Woodland II" (grit	"Late Woodland I" (shell)	
Holden No.Truro	"Early Woodland" (grit)	Middle Woodland? (grit)	Middle Woodland? (grit)	Middle Woodland? (grit;shell)	Middle Woodland? (grit)
Rose Truro	"Early Woodland" (grit)	"Early Woodland" (grit)		"Late Woodland" (shell)	
Hillside No.Truro	"Early Woodland" (grit)	"Middle Woodland" (grit)		"Early Intermediate" (shell)	"Early Intermediate" (grit)
Warren's Field No.Truro	"Early Woodland" (grit)			"Early Woodland" (grit)	"Early Woodland" (grit)
Griffin Island Wellfleet		"Middle Woodland" (grit)	"Middle Woodland" (grit) "Late Woodland II" (shell)	"Middle Woodland" (shell)	"Middle Woodland" (shell)
Cliff Truro		"Middle Woodland" (grit)			
Railroad Truro		"Middle Woodland" (? temper)			
Seth's Swamp Wellfleet		"Middle Woodland" (grit)			
Hemenway Eastham			undated (? temper)		undated (? temper)
Rich No. Truro			undated (grit)		

TABLE 13.3 Distribution of decorative techniques over outer Cape Cod sites along with their stated temporal affiliation and temper type.

Moffett relates the various Middle Woodland decorative techniques with grit-temper for the Cape (1957:5), it is apparent from the survey recoveries that shell-temper also was used by some point during this period.

The Late Woodland pottery is said to be distinct from that of the earlier period because of the prevalence of vessels with their exteriors totally covered with cordmarking (Moffett 1957:6). Fowler (1966:58) also associates the use of decorative elements such as incising, cord-wrapped stick and dentate with his Stage 3 period, which generally corresponds to the Late Woodland period. The vessels from this period are usually shell-tempered and the interior walls are often extensively scraped. The range of Massachusetts dates associated with exterior cordmarked, shell-tempered pottery is quite long (Table 13.7). The earliest associations perhaps should be questioned since a variety of post-depositional phenomena could have resulted in the mixing of sherds from different time periods. It is also conceivable that cordmarking is rather ubiquitous through time and the documentation of its use through time must be carefully outlined as more absolute dates become available.

Both Fowler and Moffett have defined a second stage of the Late Woodland which corresponds to the Contact period. The primary attributes used to distinguish the pottery are both decorative and technological. The vessels have collars and castellations upon which incisions and linear dentate stamps are applied in elaborate designs. Other characteristics of this pottery are thin walls, small shell temper, constricted necks and a globular shape. Pottery sherds displaying these attributes have not been found in the survey investigations.

The decorative techniques widely found on the outer Cape are presented in Table 13.8 by site. The temporal assignment for the technique at each site given by Moffet, who excavated the sites, and the type of temper associated with the technique also are included. It is evident that dentate and rocker stamping are very prevalent decorative types over the whole outer Cape while Vinette 1 is quite confined to the Truro/High Head area. The other techniques of incising, cord-wrap stick and scallop impressed seem to be present all over the outer Cape but not at all the excavated sites in any one area.

The next chapter describes specifically the prehistoric ceramics found in site areas and concentrations examined by the Survey. The C-14 dates received for particular concentrations will be discussed in relationship to the decorative and technological attributes of the pottery.

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CHAPTER 14

PREHISTORIC CERAMIC REMAINS

S. Terry Childs

Introduction

This chapter presents a description and analysis of the ceramics excavated in all site areas and concentrations within them. Discussion is both in general terms of all the sherds found and, more comprehensively, in terms of the identified vessel lots (see Chapter 13 for a description of how vessel lots were delimited). The prehistoric ceramic remains as they are divided into vessel lots are summarized for each site area discussed in this chapter (Tables 14.1 and 14.2). Four kinds of information are sought through the analysis of ceramic assemblages reported in this chapter: (1) stylistic, (2) technological and functional, (3) spatial and (4) chronological.

The result of the site specific analyses is an opportunity to examine regional ceramic variation among outer Cape sites. Intersite variation along the lines presented above is the subject of the final section of this chapter. The site areas are discussed in geographical order proceeding south to north from Nauset Marsh (See Foldout Maps A, B and C).

Prehistoric Ceramics, Fort Hill Area

19BN308

Site 19BN308 covers a large area of Fort Hill, much of which has been plowed or used during the historic period for a variety of purposes. The construction of a road to the top of the hill has further disturbed the site area. Despite all the relatively

TABLE 14.1

Grit-tempered Vessels

Site	Sherds Included in Vessel Lots		Sherds Not Included in Vessel Lots		Total Sherds	
	Weight	%	Weight	%	Weight	%
19BN308	47.0	96	2.1	4	49.1	100
19BN323	50.9	98	1.1	2	52.0	100
19BN273/275	0.4	100	0	0	0.4	100
19BN274/339	0	0	0	0	0	0
19BN340	0	0	0	0	0	0
19BN341	1260.7	99.9	0.8	0.1	1261.5	100
19BN288	15.3	100	0	0	0	0
19BN390	95.4	57	71.9	43	167.3	100
19BN333/3336/337	3.0	100	0	0	3.0	100
19BN374	9.3	100	0	0	9.3	100
19BN471	163.7	92	15.2	8	178.9	100
19BN481	34.9	79	9.4	21	44.3	100

Shell-tempered Vessels

Site	Sherds Included in Vessel Lots		Sherds Not Included in Vessel Lots		Total Sherds	
	Weight	%	Weight	%	Weight	%
19BN308	281.2	79	76.4	21	357.6	100
19BN323	69.0	48	75.8	52	144.8	100
19BN273/275	27.8	58	20.8	42	48.6	100
19BN274/339	622.8	78	178.0	22	800.8	100
19BN340	0	0	3.4	100	3.4	100
19BN341	388.3	56	300.6	44	688.9	100
19BN288	43.5	44	55.3	50	98.8	100
19BN390	16.2	27	43.8	73	60.1	100
19BN333/336/337	14.9	94	1.0	6	15.9	100
19BN374	52.9	85	9.4	15	62.3	100
19BN471	0	0	0	0	0	0
19BN481	2.5	100	0	0	2.5	100

Mixed-tempered Vessels

Site	Sherds Included in Vessel Lots		Sherds Not Included in Vessel Lots		Total Sherds		Grand Total Sherd Weight(g)
	Weight	%	Weight	%	Weight	%	
19BN308	62.7	91	6.5	9	69.2	100	475.9
19BN323						0	196.8
19BN273/275	7.9	100	0	0	7.9	100	56.9
19BN274/339	1.8	44	2.3	56	4.1	100	804.9
19BN340							3.4
19BN341	6.7	57	5.1	43	11.8	100	1962.2
19BN288	12.9	84	2.4	16	15.3	100	129.4
19BN390	96.3	70	41.6	30	137.9	100	365.2
19BN333/336/337	3.0	88	0.4	12	3.4	100	22.3
19BN374	2.3	100	0	0	2.3	100	73.9

TABLE 14.2

Frequency and Percentage of Vessels of Each Temper Type in Each Site Area

Site	Grit #	Grit %	Shell #	Shell %	Mixed #	Mixed %	Total # Vessels
19BN308	6	19	21	66	5	16	32
19BN323	3	38	5	62	0		8
19BN273/275	1	14	5	71	1	14	7
19BN274/339	0		5	83	1	17	6
19BN341	8	28	16	57	4	14	28
19BN288	3	21	8	57	3	21	14
19BN390	6	54	3	27	2	18	11
19BN333	1	50	1	50	0		2
19BN336	3	43	4	56	0		7
19BN337	1	50	0		1	50	2
19BN333/336/337	5	45	5	45	1	9	11
19BN374	4	36	7	64	0		11
19BN471	6	86	0		1[a]	14	7
19BN481	3	50	2	33	1	17	6
19BN410	0		1	100	0		1
TOTALS	50	32	83	55	20	13	153

[a]Mixed grit and organic

recent activity over the site, there are a number of areas with important prehistoric components associated with pottery.

Given the vast extent of the site, the total weight (475.9 g) of pottery recovered is quite small (Table 14.3). There are two concentrations where considerably more sherds were retrieved than average although these concentrations either had more excavation units dug than usual or were associated with a feature or shell midden. Overall, both excavation units and shovel test pits yielded pottery in eighteen of the twenty-six identified concentrations. Thirty-two vessel lots have been identified from thirteen concentrations, including six grit-tempered, five mixed-tempered, and 21 shell-tempered lots. These vessel lots represent 82.0% of all the sherds recovered since the vast majority of the grit- and mixed-tempered sherds could be assigned to a lot and an unusually high proportion of the shell-tempered sherds could be similarly assigned. It is conceivable that the large number of shell-tempered vessel lots identified is inflated because separations into more than one lot were made when one vessel included a high range of variation for several attributes.

19BN308, Stylistic Attributes

The distribution of decorative techniques over the site is interesting and probabaly relates to different occupation episodes in the Fort Hill area. In general, the most prevalent type of surface treatment over the site is cordmarking (Table 14.4). In almost every concentration with more than one identified vessel lot, one is cordmarked. These vessel lots, however, are more concentrated in Concentrations 308.11, .14, .21, .22, .31, .33, .34 (Foldout Map D) on the eastern side of the site. This is where Fort Hill slopes down to Nauset Bay and fairly level ground surrounds a large kettle hole. Most of the cordmarked lots are shell-tempered although one is mixed-tempered. The other shell- and mixed-tempered lots in this eastern area of the site are undecorated which suggests that whole vessels were not totally covered with cordmarking or decoration. The two hints of grit-tempered vessel lots in this area also are either undecorated or the decoration could not be determined.

The other shell-tempered vessel lots from 19BN308 are decorated with dentate stamping, fabric and cord wrapped stick impressions. These lots come from Concentrations 308.41, .42, .43 on the south and 308.71, .72 on the southwest sides of the site on level ground, close to inlets from Nauset Bay. Within these two areas are a higher percentage of grit- and mixed-tempered lots than shell-tempered lots. There also is greater variation in decorative techniques. Incising is on several vessels tempered with both grit and mixed shell and grit, while dentate, scallop impressing, and combing are also used.

TABLE 14.3

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN308

Concentration	Number of shovel test pits: with Pottery	Number of shovel test pits: without Pottery	Number of excavation units: with Pottery	Number of excavation units: without Pottery	GRIT: Undecorated	GRIT: Spalled	GRIT: Undetermined	GRIT: Cordmarked	GRIT: Dentate	GRIT: Complex Dentate	GRIT: Incised	GRIT: Cordwrap Stick	GRIT: Fabric Impressed	GRIT: Combed	GRIT: Scallop	GRIT: TOTAL WEIGHT	SHELL: Undecorated	SHELL: Spalled	SHELL: Undetermined	SHELL: Cordmarked	SHELL: Dentate	SHELL: Complex Dentate	SHELL: Incised	SHELL: Cordwrap Stick	SHELL: Fabric Impressed	SHELL: Combed	SHELL: Scallop	SHELL: TOTAL WEIGHT	MIXED: Undecorated	MIXED: Spalled	MIXED: Undetermined	MIXED: Cordmarked	MIXED: Dentate	MIXED: Complex Dentate	MIXED: Incised	MIXED: Cordwrap Stick	MIXED: Fabric Impressed	MIXED: Combed	MIXED: Scallop	MIXED: TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	12	2	0		7	8	4	5																					2									0.7	11.7
12	0	11	0	0																																				
14	3	3	1	0		4	11	4	5																					1									0.4	15.3
15	1	9	0	0			1																																	0.2
16	0	3	0	0																																				
21	1	5	1	0		10	8	2	13			5																				1								0.5	50.2
22	3	9	0	0			2		1																															3.8
23	1	6	0	0			1																																	0.2
24	0	10	0	0																																				
25	0	5	0	0																																				
26	1	6	0	0			1									0.3												0.3												
27	0	9	0	0																																				
31	2	6	0	0	1											0.3	2	1	1									3.1		2									0.6	4.0
32	1	5	0	0	1											0.7	2	3										2.0												2.7
33	6	4	1	1		1										0.8	7	28	1	4								30.6												31.4
34	0	10	1	1	2											1.0	3											1.8		1									0.9	3.7
35	0	6	0	0													1	4			1							1.7												1.7
41	0	6	3	0																																				
42	0	3	8	0	3	10	1		2	1	2		1			12.5	59	46	3	4		2		7				84.0	52	13				1					6	65.8	162.3
43	0	0	1	1													7			1								13.2												13.2	13.2
51	0	2	3	0													5	22	1	7								9.0		1									0.3	9.3
52	1	14	0	0																				1				0.7												0.7
61	0	5	0	0																				20				128.6												128.6
71	0	4	4	0							8					33.8	4	25	1									2.8												2.8
72	1	12	0	1																1																				
TOTAL																49.1												357.6												69.2	475.9

The range of decorative motifs is not large and is quite typical of the Nauset Bay region, and indeed of Cape Cod in general. Most of the motifs are simple and angular such as horizontal or vertical rows and lines of dentate, scallop impressions, or incisions. Two incised vessel lots and one fabric-impressed, shell-tempered lot have a cross-hatched pattern on the neck and rim sherds. The most unusual decorative form is the series of parallel wavy lines formed by a comb on a grit-tempered vessel. Interestingly, the scallop impressions are formed from a large shell which is broken so that two wide undulations form a single element that is repeatedly stamped in a connected fashion across the vessel. This forms a similar wavy line to that of the combed decoration.

19BN308, Technology and Function

Nearly half or 46.9% of all the vessel lots have evidence of breaking along a coil juncture with the greatest frequency among the shell-tempered lots (Table 14.4). This prevalence of coil fracture on the shell-tempered vessels occurs over the whole site which suggests that the care or method of manufacturing these vessels was consistent. Two-thirds of these vessel lots also are cordmarked, which might further suggest a relationship between the type and function of a pot and the care with which it was constructed. Presumably, these vessels were used for cooking and a combination of thermal stress and rapid manufacture may have caused their breakdown along the inadequately bonded coils. Interestingly, too, although relatively few vessel lots have carbonized residues on their interior surface (16%), four out of the five lots that do are broken along a coil and four out of five also are cordmarked. Most of the vessel lots with residues are from Concentration 308.71 in the southwestern part of the site. In this area, the currently swampy conditions may have better preserved the residues and discouraged extensive damaging activities during the historic period.

There is considerable consistency in the choice of what types of inclusions were added to the clay over the site and the divergences from the pattern are interesting. Among the grit-tempered vessel lots, most are tempered with angular quartz and crushed granite which is typical of the region. One incised and one undetermined lot have angular quartz and large pieces of mica in them which is very rare in the Nauset Bay area. The only other site with sizeable mica inclusions is 19BN341 where an undecorated and a dentate stamped vessel are tempered with fewer and smaller pieces. Examination of some sherds from 19BN471 in Wellfleet also revealed large pieces of mica with much greater consistency.

Among the mixed tempered lots, angular quartz is consistently added with the shell. The shell in these lots is usually leached out or of an undetermined nature. Among the shell-tempered lots, 43% contain scallop shell or its impressions

TABLE 14.4

Vessel Lot Attributes from 19BN308

Concentration	Vessel Number	Total No. Provenience	No. Sherds	Temper Type	Undecor.	Cordmark	Dentate	Fabric Impress.	Incised	Cordwrap Stick	Complex Dentate	Combed	Scallop	Undeterm.	Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
11	5	2	2	M										X			spalled	0.6
	14	1	4	S	X												5	2.5
	15	1	5	S		X									X		5	2.8
14	11	3	5	S		X									X		7	5.7
21	4	1	1	M		X											spalled	0.6
	12	4	17	S		X									X		6-8	25.9
	13	2	7	S	X										X		spalled	7.8
22	16	1	1	S		X											5-6	3.2
31	9	1	2	S	X												6-7	2.6
33	7	1	9	S		X											spalled	4.0
	8	1	11	S	X										X		spalled	4.6
	10	4	7	S		X									X	X	7-8	17.4
	1	1	1	G										X			spalled	0.8
34	2	1	2	G	X										X		6	1.0
	3	1	1	M	X												8	1.0
00	6	1	2	S	X												8-9	2.8
41/42	11D	2	2	S			X										5-6	1.4
42	1D	2	2	G					X								7-8	3.5
	2D	4	11	G							X						4-7	7.7
	3D	1	1	G								X					spalled	0.2
	4D	1	69	M									X		X		3-8	51.9
	5D	1	2	M					X								8	8.6
	6D	2	14	S		X									X		7-8	10.6
	7D	4	17	S	X										X		7-10	12.5
	8D	3	7	S		X									X		7-9	15.6
	9D	2	4	S						X							8-9	13.0
42/43	10D	2	10	S		X									X	X	4-7	14.9
51	1E	3	32	S		X									X	X	7	8.0
71	1F	1	8	G					X						X		6-11	33.8
	2F	5	36	S				X							X	X	5-8	122.0
	3F	1	1	S	X												7	1.3
72	4F	1	1	S		X										X	10	2.8

and 19% have quahog and/or softshell clam inclusions. Most of these latter lots are from the eastern side of the site. The greater use of scallop shell as a purposeful inclusion is typical of the Nauset Bay region.

Despite the large number of identified vessel lots only seven have sherds with discernible lip profiles and of those, only one has a relatively complete rim profile. Among the shell-tempered lots, the most common lip profile is squared, though a rounded and a tapered, flat profile are present. The single grit- and mixed-tempered lots with lip profiles are both tapered to a rounded point. These two lots in conjunction with the flat, tapered profile on a shell-tempered vessel all come from Concentration 308.42 where a considerable variety of decorative techniques and temper types are present. The single rim profile from Concentration 308.71 is slightly everted and is from a pot with an orifice of at least eleven centimeters in diameter.

It is evident from Table 14.4 that there is little variation in the range of wall thickness for a vessel lot between the temper types. Although one grit-tempered lot has a maximum thickness of 11 mm, this may be the result of inadequate care in building uniform walls. This vessel lot has several coil breaks which may have resulted from thermal stresses building up in regions with differential wall thickness. As well, this lot is one with large mica inclusions which was probably brought in from another area of the outer Cape or beyond.

The surface treatment of the interior vessel walls is consistent with the practices in the region but is relatively inconsistent over the site. The grit-tempered lots usually have smoothed walls and when discernible, the mixed-tempered lots are wiped or scraped. The greatest inconsistency is among the shell-tempered lots with fairly similar frequencies of smooth, wiped, and scraped interiors. There also is no clear correlation between scraped interiors and cordmarked exteriors among these lots. Perhaps the tightest assocation is the practice of scraping the wall interiors of the shell-tempered vessels in Concentration 308.71 in the southwestern portion of the site. The result does seem to be more uniform wall thicknesses among the sherds in each lot.

19BN308, Spatial Pattern

For reasons relating mostly to the site testing strategies at 19BN308, a number of the excavation units revealed middens or features which were associated with pottery. Shell midden is prevalent in Concentrations 308.71, .42, and .33 (Foldout Map D) where the vast majority of the pottery was recovered. The shell midden in Concentration 308.71 is very widespread and it is impossible to ascertain stratigraphic or chronological

differences between the excavated sherds. Shell-tempered sherds were present in the midden levels of all the excavation units in the concentration while grit-tempered sherds were found in only one unit with a midden level.

A number of excavation units with shell midden were excavated in Concentration 308.42 located at the base of the southern side of Fort Hill. In several of the excavation units, grit-, mixed- and shell-tempered sherds were recovered. Two grit-, one mixed-, and three shell-tempered vessel lots have been identified from the sherds excavated from the midden. A variety of decorative techniques including dentate, combing, scallop impressions, cord wrapped stick, and cordmarking are represented in the midden.

Two vessel lots were assigned from the sherds recovered in the midden found in Concentration 308.33. A single grit-tempered sherd lot and a cordmarked, shell-tempered vessel lot were excavated from the same approximate depths in the midden. A stone pavement of firecracked rock was also found in this midden at a lower level but no pottery seems to be associated with it. Perhaps some will be recovered when all of the flotation material is processed.

Another area of high density shell, but so disturbed that a midden designation could not be assigned, is in Concentration 308.11 near the top of Fort Hill. The pottery found in this area is almost exclusively shell-tempered except for a couple of mixed-tempered sherds.

Pottery is also clearly associated with two features at 19BN308. The feature in concentration 308.71 is not directly associated with the midden but contains abundant shell, bone, lithics, and unaltered stones. One fabric-impressed, shell-tempered vessel came from this feature. Its heavy coating of carbonized residue on both its interior and exterior walls suggests it failed during use and was discarded along with other household debris.

Another shell-filled feature was excavated in Concentration 308.21. The one vessel lot with members included in the feature is cordmarked and shell-tempered. A number of other sherds included in this vessel lot were retrieved from around the feature which may be the result of plowing disturbance to the upper portions of the feature.

19BN308, Chronological Implications

The vessel lots identified in the concentrations on the east side of Fort Hill (308.11, .14, .21, .22, .31, .33 and .34) all strongly suggest a Late Woodland occupation. This is due to the prevalence of cordmarked, shell-tempered pottery, and supported by the large number of Levanna projectile points recovered from

these concentrations. The C-14 date (1040 +/- 145) from an excavation unit in Concentration 308.33 and associated with cord-marked, shell-tempered pottery conforms to the Late Woodland designation.

The numerous vessel lots identified from Concentrations 308.41, .42 and .43 on the south side of Fort Hill strongly suggest an earlier occupation than on the east side. Decorative techniques used on sherds found there include: incising, dentate impressions, scallop impressions, and possibly combing. These techniques were typically used in the Middle Woodland and into the Late Woodland period. The wide variety of techniques is also characteristically Middle Woodland. Similar scallop shell impressions were found here as on a shell-tempered vessel at Concentration 19BN274/339.12 which is clearly Middle Woodland. The few diagnostic points found in these concentrations are a Jack's Reef and a Squibnocket Triangle, the former supporting a Middle Woodland occupation. The C-14 date from a shell midden in Concentration 308.42 was not directly associated with any pottery. Its early date (1310 BC +/- 135) helps confirm the earlier presence of people in this area but seems to be considerably earlier than what is suggested by the pottery.

The single cordmarked, shell-tempered vessel lot found in Concentration 308.51 near a pile of fire-cracked rocks and in the flat area on the south side of Fort Hill should be assigned a Middle-to-Late Woodland occupation. Its abundant and large shell temper as well as the fine, lightly executed interior wall scraping are similar to vessel lots from Concentration 308.71 to the west. Curiously, five Squibnocket Triangle projectile points were recovered in this concentration the majority of which came from the same excavation units as the majority of the pottery. This association between the pottery and points does not conform with Ritchie's (1969:215ff) discussion of the Squibnocket component.

Finally, the vessel lots identified in concentration 308.71 and .72 on the west side of Fort Hill cannot be firmly assigned to a period of time. The three shell-tempered vessel lots could be from the Middle to Late Woodland while the incised, grit-tempered lot was probably imported at an unknown period of time. Unfortunately, no diagnostic lithic artifacts were excavated in this area.

19BN323

Site 19BN323 is located to the north of Fort Hill in a field which formerly was extensively plowed. Although the whole site encompasses a large area, the main occupation area identified is along the southern edge of a large kettle hole very near to the cliffs over Nauset Bay.

TABLE 14.5

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN323

Concentration	Number of shovel test pits		Number of excavation units		GRIT																	SHELL											MIXED														
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	7	0	0																																							46.0
12	0	7	1	2	1			2								46.0																											46.0
13	0	3	0	2																																							2.9
14	0	6	0	2																																							143.9
15	0	5	0	0																																							3.0
21	0	4	2	1													3	1	1									2.9															1.0
22	0	3	5	1	4	3	1		1							5.8	74	105	13	41	6			1			1	138.1															196.8
23	0	1	2	0		1										0.2		6	1									2.8															
24	0	0	1	1													1	2	1									1.0															
TOTAL																52.0												144.8															

The total weight of pottery recovered from the site is small (196.8 g) and the majority comes from the one concentration area where the densest deposits were excavated. Pottery sherds were found only in five of the nine delineated concentrations (Table 14.5). Eight vessel lots and one pipe have been identified from three concentrations including three grit-tempered and five shell-tempered lots. Two untempered sherds from a pipe were also recovered from concentration 323.22. The vessel lots represent 60.9% of all the sherds excavated from the site. Although 98% of all the grit-tempered sherds could be assigned to a vessel lot, only 48% of the shell-tempered sherds could be similarly assigned due to their spalled and indistinct condition (Table 14.1). The relatively small amount of pottery, the predominance of shell-tempered sherds and their tiny fragmented nature is typical of Nauset Bay sites.

19 BN323, Stylistic Attributes

Two of the three grit-tempered vessel lots are decorated with dentate stamping while the third lot is undecorated. One of these lots was recovered in a concentration, 323.12, considerably removed from the main area of dense remains and in an excavation unit close to a stone wall. Possibly this vessel lot, which has horizontal rows of dentate forms applied simultaneously, represents a small occupation unit removed from the other area in time.

The shell-tempered vessel lots have more variety of decorative techniques including cordmarking, scallop impressions, dentate, and an undetermined form. The only decorative motif discernible on these vessel lots is that of a chevron made with scallop impressions which is also common to the Nauset area. A similar emphasis on triangular forms occurs at nearby 19BN308 as does the presence of dentate stamping on both grit- and shell-tempered vessels.

The pipe bowl fragment is uniquely decorated with a series of punctations possibly formed from a broken stick end executed in a series of vertical rows. This use of punctations for decorating pipes is unique for the Nauset Bay region.

19BN323, Technology and Function

The assemblage includes both grit- and shell-tempered vessel lots with carbon residue and coil breaks (Table 14.6). In no case are the residue and coil breaks evident on the same vessel as would be expected from prolonged cooking use. The one shell-tempered lot with coil breaks has much more extensive damage along the coils than is typical. This suggests very poor bonding during manufacture.

TABLE 14.6

Vessel Lot Attributes from 19BN323

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
12	1	1	3	G			X									X	7-12	46.0
22	2	2	2	G	X												6-9	2.3
	3	1	5	G			X								X		8	2.6
	4	1	1	S									X				6	9.1
	5	3	6	S			X										3-7	2.8
	7	4	5	S		X										X	5-7	9.6
	8	9	38	S		X									X		6-8	44.9
	9[1]	2	2	UNT													3-7	1.3
23	6	1	6	S										X			spalled	2.6

NOTES

[1] Pipe, no temper present; Punctate Surface Treatment/Decoration

There is considerable consistency in the materials used to temper the clay at this site. The grit-tempered lots all have quartz added to the clay while two of the five shell-tempered lots have evidence of scallop additions. The exclusive use of quartz is not common in the Fort Hill area, although its use in conjunction with crushed granite is typical at 19BN308. Scallop shell is commonly used as a temper throughout the Nauset Bay region.

As seems to be typical of the region, the grit-tempered vessel lots have a greater wall thickness than the shell-tempered lots. The range in thickness in single vessels seems to be greater for the grit-tempered lots versus those with shell. This may relate to the difficulties of working with large pieces of stone in the clay. All of the grit-tempered lots were smoothed after wall construction, probably to minimize the effects of the temper irregularities. Two of the shell-tempered lots have scraped interiors, one of which was executed in very regular, thin striations, obviously with considerable care. This lot was the one with carbon residue but whether the scraping has any functional relationship to cooking is unknown.

19BN323, Spatial Pattern

Two features containing predominantly shell but also lithics and bone were excavated in concentration 323.22. A relatively small amount of pottery was recovered from one of these features. Two vessel lots are identified from sherds excavated both from within the feature and from above it. Both lots are shell tempered and one is cordmarked and has carbon residue on it while the other is scallop impressed. Although it is likely that the feature was not filled in one episode, it is impossible to determine the degree of contemporaneity of the vessel lots. The types of artifacts recovered in the feature suggest that it was a general refuse area probably in the vicinity of a living area.

19BN323, Chronological Implications

The stratigraphic relationships of the shell and grit tempered pottery found at this site are interesting. In all cases of the identified vessel lots, the grit-tempered ones predominantly came from the mottled level under the plowzone. The shell-tempered lots came from the plowzone.

Decorative techniques such as dentate stamping, scallop impressions, and punctate began to become popular in the Middle Woodland period and were used to some extent into the Late Woodland. Cordmarking was used extensively in the Late Woodland. In corroboration with the decorative techniques, the diagnostic projectile points also suggest a late Middle Woodland-Late Woodland occupation. The majority of the points excavated in the concentrations with pottery are Levannas. The C-14 dates from

one of the shell features strongly suggest a Late Woodland occupation (A.D. 1770 +/- 115; A.D. 1440 +/- 110).

Prehistoric Ceramics, Southern Side of Salt Pond

19 BN273/275

The pottery at 19 BN273/275 is localized in excavation units dug in two of the six identified concentrations, 273/275.31 and .32 (Foldout Map E). Concentrations to the south and southeast of those with pottery are located in open fields that probably once were plowed. Post-depositional disturbance by historic plowing and landscaping coupled with testing the area with only shovel tests may explain the lack of pottery in the other concentrations.

The amount of pottery found within 273/275.31 and .32 is small (Table 14.7). The vessel lots represent 58% of the total excavated pottery by weight (Table 14.1). The majority of the sherds by weight and the vessels identified are shell-tempered although other temper types are represented. All of the grit- and mixed-tempered sherds could be assigned to a vessel lot but only 58% of the shell-tempered sherds could be similarly assigned due to spalling, small sherd size, and ambiguous attributes.

The pottery found in Concentration 273/275.32 was excavated in EU 4. Three shell-tempered sherds weighing 0.7 g were recovered. Although some sort of decoration or surface treatment is visible on two of the sherds, the technique cannot be distinguished and no associations with 273/275.31 can be made.

The tiny amount of pottery excavated in this concentration does not permit any assessment of their stylstic, technological/functional, cultural and chronological associations and implications.

19BN273/275, Stylistic Attributes

No decoration is visible on either the grit- or mixed-temper sherds (Table 14.8). All of the designated shell-tempered vessel lots have exterior markings or decoration: three are cord-marked, one is impressed with a cord-wrapped stick and another with scallop shell. Only the cord-wrapped stick decorative technique can be associated with a decorative motif. This motif is groups of several closely spaced vertical rows separated by several closely spaced diagonal rows. The range of decoration types for the shell-tempered vessels is typical of the Nauset area with cord-marking being the most prevalent exterior treatment. Due to the small number and size of the sherds, it is

TABLE 14.7

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN273/275

Concentration	Number of shovel test pits		Number of excavation units		GRIT												SHELL												MIXED													
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	10	0	0																																					
12	0	5	0	0																																					
13	0	4	0	0																																					
21	0	5	0	0																																					
31	0	3	2	2	1											0.4	14	57	1	39				6		1		47.9	10	7	1									7.9	56.2
32	0	3	1	0													1		1									0.7													0.7
TOTAL																0.4												48.6												7.9	56.9

possible that the cord-marked sherds are the lower body sherds of vessels decorated with scallop or a cord-wrapped stick at the neck or shoulder. Examination of the paste and temper density chiefly was used to distinguish vessel lots. No rim sherds were found.

19BN273/275, Technology and Function

Several interesting observations can be made concerning the technological and functional characteristics of the vessel lots. Three of the five (60%) shell-tempered vessel lots have coil breaks which is higher than the average for the Nauset area (Table 14.8). This suggests inadequate care in the bonding of coils during manufacture with the subsequent weakening of the vessels' walls. The mixed-temper vessel lot has both coil breaks and residue.

Four of the six vessel lots with shell inclusions were tempered with scallop shell. It has been observed that vessels with voids or with irregularly shaped temper are more resistant to crack propagation and irregular inclusions can bond with the clay better. The use of scallop as a temper by the local potters may represent an understanding of these properties and that they associated the surface irregularity and the inherent firability of scallop with an increase in manufacturing and functional effectiveness. Examination of shell frequency by species overall in 19BN273/275 shows that scallop is not present. This suggests that it was selectively collected for use as temper in pottery manufacture in this area.

There is a considerable amount of iron oxide nodules in all the vessel lots suggesting two things. One is the use of the same or similar clay resource for the manufacture of the vessel lots found in the concentration area. The second observation is the obvious lack of refinement of the clay after procurement to improve grain size uniformity. This practice would increase vessel strength during firing and use.

19BN273/275, Spatial Patterns

The technological attributes of the vessel lots in conjunction with their spatial location near a dense fire-cracked rock concentration in Concentration 273/275.31 suggest that at least some of the vessels were used in cooking. Poorly bonded coils, no refinement of the clay to remove iron oxide nodules, and the use of dense amounts of large, poorly sorted particles suggest the expedient manufacture of the vessels. The use of scallop shell, however, might indicate special attention to that aspect of manufacture. The strong association of pottery with dense fire-cracked rock fits into a general pattern of similar associations in the Nauset area.

TABLE 14.8

Vessel Lot Attributes from 19BN273/275

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
31	1	2	18	M	X										X	X	8	7.9
	2	1	1	G	X												spalled	0.4
	3	4	30	S		X									X		6-7	17.1
	4	1	4	S		X											5-6	1.6
	5	1	1	S									X		X		spalled	0.2
	6	2	11	S						X							spalled	4.7
	7	2	4	S		X									X		spalled	4.2

19BN273/275, Chronological Implications

The pottery does not provide any chronological implications. Shell-tempered vessel lots are identified in all soil horizons, the one grit-tempered sherd and the majority of the mixed-tempered vessel lot were found within the mottled soil horizon.

The presence of the single grit-tempered sherd is curious. It could mean an earlier occupation component or the occasional manufacture of grit-tempered vessels during a period when predominantly shell-temper was made. Since no projectile points or other diagnostic artifacts were found in these concentrations, the period of occupation is unclear.

19BN274/339

The pottery at 19BN274/339 (Foldout Map E) was excavated from two concentrations, 274/339.12 and .13 (Table 14.9). Only one shovel test at the site contained pottery and it was located in the midst of a subsequent block excavation in Concentration 274/339 12. Since no pottery was in the small excavation units dug in several of the other concentrations, it is likely that the pottery was confined to this one area at the site.

The pottery found in Concentration 274/339.13 was excavated from Excavation Unit 15. Six fragments of shell-tempered pottery weighing a total of 2.7 g were recovered. Three of the sherds were undecorated and the other three spalled so that no vessel designation or associations with the pottery at nearby 273/339.12 could be made. The small amount of pottery excavated in Concentration 274/339.13 does not permit an assessment of their stylistic, technological/functional, cultural, and chronological associations and implications.

The total amount of pottery excavated from Concentration 274/339.12 was 803.7 g, from which six vessel lots and one pipe were identified (Table 14.9). These vessel lots constitute 78% of the total shell-tempered sherds and 44% of the total mixed-tempered sherds by weight (Table 14.1). Almost all of the sherds by weight are shell-tempered but a few mixed-tempered sherds were identified and constitute one vessel lot. No grit-tempered sherds were excavated which is unusual for the Nauset area.

19BN274/339, Stylistic Attributes

The stylistic complexity and variation of the vessel lots in 274/339.12 is unique for the Nauset area. Although the sherds of the mixed temper lot are not decorated, the five shell-tempered

TABLE 14.9

Locations of Pottery Sherds and the Frequency by Decorative Technique at 19BN274/339

Concentration	Number of shovel test pits		Number of excavation units		GRIT												SHELL												MIXED												GRAND TOTAL WEIGHT (g)
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	
11	0	2	0	1																																				0
12	1	3	8	2													178	175	1	20		1	30	11		1	6	798.1+	6	2										4.1	802.2
13	0	1	1	1													3	3										2.7												2.7
21	0	3	0	0																																				0
22	0	4	0	3																																				0
31	0	6	0	5																																				0
32	0	2	0	0																																				0
41	0	4	0	0																																				0
TOTAL																												800.8												4.1	804.9

NOTES:

+ Six punctate shell tempered sherds are included in total weight

vessel lots exhibit a variety of decorative techniques and motifs. The decorative techniques employed by the local potters included incising, punctation, cord-wrapped stick impression, carved scallop impression and dentate. Two or three of these techniques sometimes were combined on a single vessel. The typical type of decorative motif was geometric with triangles, chevrons, herring-bone and diagonal lines predominating. Vessel #1, for example, was decorated with chevrons incised on the rim and large, deep punctate regularly spaced underneath followed by horizontal rows of impressions by a cord-wrapped stick. The rim of vessel #5 was decorated with repeating sets of triangles inside one another executed with a dentate stamp and incising. Its body does not appear to have been decorated but was smoothed and wiped before complete drying.

Although the decorative techniques and the specific decorative motifs of the vessel lots vary, there is a stylistic uniformity. An overwhelmingly consistent use of geometric shapes based on the triangle is evident. Where decorative motifs have been identified in other concentrations within the Nauset area, the triangle-based design and horizontal parallel lines predominate. These motifs also have been observed in other locations on the outer Cape, on Martha's Vineyard (Ritchie 1969), and on Calf's Island in Boston Harbor (Luedtke 1980).

19BN274/339, Technology and Function

A number of observations can be made concerning the technological and functional characteristics of the vessel lots. Coil breaks were observed on two of the five shell-tempered vessel lots and on the single mixed-tempered lot (Table 14.10). This seems to be typical of the Nauset area and further emphasizes the insufficient care taken during vessel construction to bind the coils together for strong walls.

None of the vessel lots show any sign of residue despite the presence of rim sherds in several of the lots. This stands in marked contrast to several of the concentrations at 19BN341 where the majority of vesel lots had residue. The possibility that post-depositional actions removed the residues must not be eliminated. The obvious implication, however, from the lack of residue is that the final use to which the vessels were put was not related to cooking.

Four of the five vessel lots and the pipe fragment all have rim sherds which permits more insight into vessel morphology than is typical from the Nauset area concentrations. The vessel lips are a variation of a square profile: flat topped with or without a lip or overhang or an inwardly angled square profile. Three of these four vessel lots are fairly straight-sided such that their rim angle is 90-100 degrees outward. The vessel rim diameter for these lots is between 10-13 cm. A single rim sherd which represents the fourth vessel lot has a much greater rim angle of

TABLE 14.10

Vessel Lot Attributes from 19BN274/339

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
12	1[1]	4	17	S					X	X					X		8-10	75.2
	2	5	18	S									X		X		5-8	54.0
	3	2	17	S					X								8-11	31.3
	4[1]	1	1	S													5-6	2.4
	5	15	73	S			X		X								8-12	461.4
	6	3	3	M	X										X		9	1.8
	7[2]	1	1	S	X												3-6	1.5

NOTES

[1] Punctate Surface Treatment/Decoration

[2] Pipe bowl fragment

approximately 130 degrees, suggesting a bowl shape. Since no basal sherds were found, it is impossible to estimate the overall vessel shapes of the other vessel lots.

Interestingly, the two vessel lots with squared rim profiles have thicker rim walls. These form 12-13 cm rim diameters and are tempered with large pieces of densely packed shell. Since there is so little data on rims and vessel morphology from the Nauset concentrations, it is impossible to know if these associations are typical.

The majority of the vessel lots were tempered with large, poorly sorted shell that in three cases, including the mixed-tempered lot, has leached out. A correlation between larger temper size, medium shell density, and the presence of coil breaks cannot be made given the small sample size. The presence of such shell, however, would not have provided good body strength or resistance to crack initiation during thermal stress. One vessel lot has a low density of small shell fragments that would have been more functional in situations of thermal stress since the temper uniformity increases vessel strength.

Iron oxide nodules occur as natural inclusions in most of the vessel lots. Since they vary in size range and quantity between the vessel lots, it is possible that the clay in which they are embedded came from several different sources or strata in a large clay bed. It is also possible, however, that several of the vessel lots were made from the same clay. The pastes with low densities of the nodules may represent some attempt at clay refinement prior to vessel manufacture. If so, however, clay preparation was not consistently or even frequently done given the common presence of vessel lots with large iron oxide inclusions throughout the Nauset area.

A final technological observation on the vessel lots is the interior surface treatment which was executed with a variety of techniques. The surfaces were smoothed, wiped and scraped independently or in combination. The lack of consistency suggests that the methods chosen may have related to the condition of the vessel upon the initial completion of the form or to the availability of tools, rather than to a standardized manufacturing procedure or decorataive technique.

The clay pipe does not seem to have been decorated. Both surfaces, however, were wiped so that an irregular surface texture is visible. The interior of the bowl sherd shows no signs of burning which implies that post-depositional actions may have altered the original surface. This observation is consistent with the surprising lack of organic residue on the pottery vessels. The pipe sherd is tempered with a small amount of poorly sorted shell. This is unique to the Nauset area where the other few excavated pipe fragments are untempered. The shell inclusions probably facilitated the formation of the thin walled

bowl by increasing the clay plasticity and providing better binding capabilities once the shell was aligned with the wall curvature.

19BN274/339, Spatial Pattern

All of the vessel lots identified in Concentration 274/339.12 come from a block excavation in which an anomalous, but probable, hearth was located. The overwhelming majority of the sherds excavated come from Excavation Units 18, 19 and 22, where the hearth-like feature was found. This concentration of sherds and the associated vessel lots around the hearth-like area suggests that prehistoric activities linked to ceramic use occurred there.

The uncommon lack of residue on the vessel rims suggests that the final function of the vessels was not related to cooking but may have been for storage of some sort. Three of the six shell- and mixed-tempered vessel lots exhibited coil breaks which might be explained by thermal stress and shock during cooking (Table 14.10). The initiation of the cracks and the weakening of the poorly bonded walls, however, could have started during the firing of the vessels or when a pot functioned for cooking earlier in its life.

The very high density of flakes and the unusually high frequency of projectile points found in the block excavation and particularly around the hearth-like feature further suggests activities that were not exclusively related to cooking.

The other archeological feature excavated in this concentration is located in Excavation Units 16 and 23, approximately five meters to the east of the hearth-like feature. It is a small, shell-filled pit. One tiny, spalled, shell-tempered sherd fragment was found in the feature. The sherd may be a part of vessel #5, portions of which were excavated in the surrounding excavation unit. It is safe to say that pottery was not associated strongly with this feature, however, especially since sherds from vessel #5 were spread around all of the units in the block excavation.

19BN274/339, Chronological Implications

The pottery, in combination with diagnostic lithics found within the block excavation in 274/339.12, suggests a Middle to Late Woodland occupation. Many of the attributes of the shell-tempered vessel lots share similarities with Moffett's Stage 1 of the Late Woodland period (1957). The observed decorative techniques, however, are typical of Middle Woodland sites from other parts of New England (see Chapter 13).

Woodland period designations respectively to these two strata. Although it is my impression that the 274/339.12 pottery bears greater resemblance to the stratum 3 pottery at the Cunningham site, a major difference between sites is the complete lack of grit-tempered pottery at 274/339.12 and its high frequency at Cunningham. Explanations for this discrepancy might be the immediate availability of raw materials for temper, the personal preference of one temper type over another by local potters, or the use of different tempers for different vessel functions.

The presence of six Jack's Reef corner-notched points, three possible Squibnocket points, and four probable Levanna points in the block excavation area further supports a Middle-Late Woodland occupation. One of the Jack's Reef points was found in the hearth-like feature area where the majority of the pottery was recovered. Three C-14 dates have been recently received which strongly supports a Middle Woodland occupation (A.D. 685 +/- 30; A.D. 380 +/- 120; A.D. 665 +/- 120). The latter date comes from the putative hearth area where the greatest concentration of pottery occurred.

19BN341

The site area of 19BN341 (Foldout Map E) is distinct among the site areas on the south side of Salt Pond since a majority of its delineated concentrations contain pottery (Table 14.11). Sherds were recovered in six (341.11, .21, .22, .23, .24 and .26) of the eight identified concentrations; three concentrations (341.11, .22 and .26) contained very small amounts. These three concentrations were tested by shovel tests or 50 x 50 cm excavation units that might have affected the recovery of the pottery; however, pottery was found in both testing contexts. Due to the extensive occurrence of pottery in this site area, Concentrations 341.21, .23 and .24, which contain substantial pottery, will be described individually.

Concentration 341.21

This concentration is located up a rise from an inlet off Nauset Bay and is situated on flat terrain. A total of 164.4 g of pottery was recovered from three adjoining excavation units (17, 22, 23) and one nearby shovel test pit (902). Seven vessel lots and one pipe are identified from this area (Table 14.12). An eighth vessel lot of mixed temper comes from both Concentration 341.21 and .23. The majority of the six sherds constituting this lot come from 341.23 so it will be discussed with other vessels from that concentration. These vessel lots are composed of 54% of the total grit-tempered sherds, 37% of the

TABLE 14.11

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN341

Concentration	Number of shovel test pits		Number of excavation units		GRIT														SHELL												MIXED													
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	1	5	0	0													1	1										2.0														2.0
21	0	0	3	0	7	12										13.4	42	195	15		23	3	1	23		2		134.6	7	3							2				6.4	154.4
22	1	6	0	3													1											0.9														0.9
23	0	3	4	0	40	188	1			199						1235.0	65	174	6		44							146.4		4	1										2.2	1383.6
24	1	1	9	0	4	14	2			4						11.7	105	614	24		248	1	3	13	2			403.0	1	2	1								1		3.2	417.9
25	0	2	0	2																																						
26	2	0	1	0		1										1.4		1				1		1				2.0														3.4
27	0	3	0	1																																						
TOTAL																1261.5												688.9													11.8	1962.2

TABLE 14.12

Vessel Lot Attributes from 19BN341

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined	Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
24	4	2	6	G			X									X	8-9	4.5
	5	6	13	G			X								X	X	6-7	6.7
	6	1	1	G			X								X	X	spalled	0.5
	11	1	1	M									X			X	spalled	0.7
	12	3	3	M										X		X	5	0.9
	13	26	139	S		X									X		5-9	116.3
	14	12	62	S		X									X		5-7	38.1
	15	12	96	S		X									X	X	7-10	67.0
	16	2	26	S		X									X		5-7	13.9
	17	2	5	S	X										X		7-8	5.6
	18	2	4	S		X									X	X	8-9	5.9
	19	2	3	S						X							5	1.1
	20	1	1	S			X										spalled	0.7
26	8	1	1	G										X		X	spalled	1.4
21	3	2	16	G	X											X	4-13	12.2
	7	1	1	G	X											X	3-5	0.4
	9	2	5	M				X							X	X	6-9	2.9
	24	3	7	S						X						X	7-11	13.5
	25	6	22	S		X									X	X	7-10	17.6
	26	3	18	S						X						X	9-10	11.8
	27	2	3	S			X									X	spalled	1.7
	28[1]	1	1	UNT	X												3-6	5.0
21/23	10	3	6	M	X											X	spalled	2.7
23	1	9	420	G							X				X	X	4-12	1232.8
	2	2	2	G	X										X	X	7	2.2
	21	5	28	S		X									X		8-9	17.9
	22	4	15	S		X									X	X	7-11	61.3
	23	2	10	S		X									X		4-6	5.0
	29	1	10	S		X									X		5-8	5.4

NOTES

total shell-tempered sherds and 45% of the total mixed-tempered sherds by weight recovered from this concentration. The small size (e.g., 303 shell-tempered sherds weigh 134.6 gms.) and their frequently spalled exterior make vessel designations difficult. Two of the vessel lots are grit-tempered, one is mixed-tempered, four are shell-tempered and the pipe stem is untempered.

Concentration 341.21, Stylistic Attributes

The decorative variation and complexity of the vessel lots from 341.21 is not large. The grit-tempered lots do not show any evidence of decoration which may be a function of the small number of sherds representing each lot. These two vessel lots were distinguished primarily by temper type, size, and density as well as paste characteristics. The one mixed-tempered lot is fabric-impressed.

Of the shell-tempered vessel lots, two are impressed with a cord-wrapped stick, one is cord-marked, and the other has dentate impressions. The cord-wrapped stick impressions are aligned in horizontal rows on one vessel and in vertical rows on the other. The dentate impressions are too incomplete to identify a decorative motif.

The portion of the pipe found is the whole stem. Typically, it is not decorated but there are flat planes on its exterior surface created from smoothing actions.

The lack of decoration on the grit-tempered vessel lots is surprising given the fairly high frequency of decoration on grit-tempered pots from the Nauset area. Low sherd frequency and size as well as the position of the sherds on the vessel may contribute to this phenomenon. The range of decorative techniques for the mixed- and shell-tempered vessel lots is quite typical for the Nauset area although more cord-marked vessels are the general rule.

Concentration 341.21, Technology and Function

The technological and functional characteristics of the vessel lots from 341.21 are fairly typical of the area to the south of Salt Pond. An obvious difference, however, is in the frequency of coil breaks and residue observed among the vessel lots (Table 14.12). None of the grit-tempered lots, the one mixed-tempered lot and only one of the four shell-tempered lots have evidence of coil breaks. This fact is interesting in relation to the presence of organic residues on the sherds of the vessel lots. All of the seven vessels have carbonized residue on the interior of the rim and body sherds. This strongly suggests a final cooking function for the vessels of all temper types and the possibility that they broke during or just following cooking.

No correlation can be made between the presence of residue and coil breaks. This would be a logical association if thermal stress from cooking reacted along weak coil junctures causing the vessels to break. The prehistoric cooking technique to which these vessels were subjected utilized a low, even heat such as simmering which has minimal thermal stress. Alternatively, greater care in vessel manufacture and coil bonding than is often indicated might have yielded a stronger body that could withstand thermal pressures. Evidence for the latter attempt is seen on one grit-tempered sherd where the fracture line is along a widened and flattened coil suggesting that they were pushed together and overlapped.

All of the vessel lots are made with large, poorly sorted, medium density temper of the various types. These attributes will reduce a vessel's resistance to crack initiation under thermal shock and do not provide good body strength during firing or under situations of thermal stress such as heavy cooking. The grit-tempered vessel lots are further strained under thermal conditions by their temper type since quartz and granite have a much higher thermal expansion rate than clay. This expansion difference between the clay and the temper can set up stresses which will become manifest during use if the vessel survives the initial firing. These observations would not support an hypothesis for long vessel life expectancy associated with any of the temper types when cooking techniques such as heavy boiling are used. Simmering under a low, even heat, however, might not be damaging to the vessels if adequate care was taken during manufacture to evenly distribute the nonplastic inclusions in the clay, bond the coils together well, and maintain a fairly regular wall thickness.

Scallop shell was used in all four of the vessel lots from Concentration 342.21. This frequency of occurrence is similar to that observed at nearby Concentration 273/275.31. The irregular surface area of the scallop shell promotes better bonding of the clay to non-plastic inclusions and better resists crack propagation under thermal stress. The overall occurrence of scallop at Concentration 341.21 is infrequent, making up less than 1% by weight of the total shell excavated. This strongly suggests that scallop was specifically selected for use as pottery temper.

Iron oxide nodules are also present as natural inclusions in some of the pottery. The inclusions do not occur in the grit- and mixed-tempered vessel lots, but large nodules are present in two of the four shell-tempered vessel lots. The large nodules retained in some pastes suggest that no clay refinement was practiced prior to vessel formation. Several different clay sources may have been used for the manufacture of the vessels. This might be particularly true for the grit- and mixed-tempered vessels versus the shell-tempered vessel lots.

A few of the vessel lots have rim sherds permitting some assessment of vessel morphology. One grit-tempered vessel lot has a thick (10 mm) rim with a rounded point as a lip tapering to 4-6 mm thick. It flares slightly outward but the rim angle and vessel diameter could not be determined from it. Two shell-tempered vessel lots have rim sherds. One has a 7-9 mm rounded lip on a 9-11 mm thick rim that slopes inward slightly in profile. The other has a 9-10 mm squared lip that slopes outward at an approximate 105 degree angle. These attributes seem fairly typical of the Nauset area given the very small sample size for comparison.

A final technological observation of the vessel lots is their surface treatment. The grit-tempered vessels were smoothed and/or wiped on the interior and exteriors, the mixed-tempered lot was wiped on the interior and smoothed on the exterior, while the shell-tempered lots' interiors were wiped and/or scraped and their exteriors smoothed or cord-marked. The lack of consistency in methods chosen suggests a finishing technique based on the convenience of tools available or the condition of the vessel after initial formation. Very thick walls might necessitate scraping if the temper is not too densely packed. Wiping and smoothing might be suitable to render the walls a more appropriate thickness if the temper is chunky and densely packed.

The clay pipe stem wall varies in thickness from 6-3 mm between the smoke hole and the exterior. The fact that the pipe is untempered suggests that the clay used was plastic enough in its natural state to permit careful hand-forming of a small object. A few tiny sand particles are present on the exterior surface but probably relate to the pipe formation and the use of sand to prevent the clay from sticking to the surface on which it was made. Several flattened planes on the pipe stem may have occurred during smoothing the surface. Minimal care was taken in the execution of the smoke hole since it is severely skewed between the stem lip and the point at which it enters the pipe bowl.

Concentration 341.21, Spatial Pattern

Excavation Units 17, 22, and 23, in which all of the identified vessel lots were found, encompass a large, horizontal spread of shell midden. The intact midden in Concentration 341.21 is a thin spread of material up to 7 mm thick at the base of the plowzone. Much of the pottery was directly related to this midden, either in the intact portion or the overlying plow-disturbed portion. The presence of the pottery with clear associations to cooking activities within the midden suggests that the refuse came from nearby domestic quarters. Although no house floors were found during the excavations, the topography of the site area and the artifact densities from the shovel test pit data strongly point to the possibility of house floors to the west of the midden.

Concentration 341.21, Chronological Implications

The impression emerging from the data is that two occupations might be represented since the grit-tempered pottery is predominantly below the shell midden. As well, the diagnostic projectile points from the area suggest a Late Woodland and a Late Archaic occupation. The majority of points from 341.21 are Levannas found in and above the shell midden. Several Beekman-like points were also excavated in the area although they came from the plowzone soil horizon. Two recently received C-14 dates taken from the thin lens of shell midden also point to a Late Woodland occupation (A.D. 950 +/- 140; A.D. 555 +/- 155; see Chapter 8). No further support for a Late Archaic occupation is available.

Concentration 341.23

Also situated on level terrain, this concentration is west of 341.21. A total of 1383.6 g of pottery was excavated from three adjoining excavation units (9, 13 and 18) and one nearby excavation unit (16). Eighty-nine percent of the total sherds by weight are from one vessel; a total of seven vessel lots were identified (Table 14.12). Since the single mixed-tempered vessel lot consists of a majority of sherds from 341.23 and one sherd from 341.21, it will be discussed in this section. Because of the distinct nature of the grit- and mixed-tempered sherds in terms of decoration and temper attributes, all of these sherds could be placed into vessel lots. Only 61% of the total shell-tempered sherds by weight, however, could be grouped into four vessel lots for the usual reasons of spalled exteriors, small sherd size, and ambiguous attributes.

Concentration 341.23, Stylistic Attributes

There is very little decorative variation among the identified vessel lots at Concentration 341.23. The most interestng and only true decoration present is on a large, grit-tempered vessel. The decorative technique used is a complex of dentate forms that were applied simultaneously across a damp and plastic vessel surface. The dentate forms include short diagonals and short horizontal lines. The motif involves distinct groups of five horizontally parallel rows over which a dentate implement was rocked. Wide spacing occurs between the sets. This decorative technique and motif is fairly common on other grit-tempered vessels in the area as well as at the Mattaquason Purchase site in North Chatham (Eteson et al. 1978). The other grit-tempered vessel lot does not have any decoration on the two sherds that represent it.

The mixed-tempered vessel lot also does not have any decoration; however, all four of the shell-tempered vessel lots are cord-marked. Although the cord-marking was probably derived

from paddling the surface after building it up with coils, the retention of the marking suggests it had some aesthetic or functional purpose. The twist of the cord used on the paddle for one vessel could be distinguished as a Z-twist, which is consistent with other cord-marked vessels at 19BN341. The four different shell-tempered vessel lots were identified by attributes such as temper size and density, paste texture and color, wall thickness, and natural inclusions. The lack of any other decorative technique on the shell-tempered vessel lots is unusual, although it may be due to the lack of rim sherds where other decorative elements would commonly occur.

Concentration 341.23, Technology and Function

The frequency of coil breaks and carbonized residues among the identified vessel lots in Concentration 341.23 differs significantly from the frequencies in Concentration 341.21 (Table 14.12). Although there is no evidence of coil breaks on the mixed-tempered vessel, both of the grit-tempered and all four of the shell-tempered vessel lots have evidence of fracture along the coils. This implies inadequate attention to the bonding of the coils, resulting in weakness and breakage from thermal or impact stresses. Heat stress might be hypothesized as a likely stimulus for the fracturing; however, the complementary evidence of carbonized residues on the vessels indicating cooking is not always present (Table 14.12).

It is possible that the lack of rim sherds in the vessel lot assemblages is skewing these frequencies since there is a pattern of cooccurrence between the presence of residue and rim sherds over many concentrations in the Nauset area.

There is a fair amount of variation in the specific tempering materials used within a general temper type, in temper size and in the density of temper among vessel lots. The two grit-tempered vessel lots, for example, differ substantially: one consists of angular quartz, crushed granite and mica pieces and the other contains sand grains. Although the temper in both vessel lots is poorly sorted, the former lot has predominantly larger inclusions than the latter. The mixed temper vessel lot, although tempered with an unknown type of shell and angular quartz, also has smaller, more homogeneous grains. Despite the potential benefits of the smaller grains, both of these vessels have fracturing along coils. In these two cases, inadequate construction techniques in combination with their probable use in cooking, both have residue, seem to have countered the benefits of small, homogenous temper.

The temper has been leached out of all of the shell-tempered vessels; however, two of the vessel lots have scallop shell impressions. Their presence conforms to the use of scallop at Concentrations 341.21 and 273/275.31 and shows some technological consistency in pottery manufacture in an area. All of the vessel

lots have poorly sorted temper, but two have somewhat finer, more homogeneous grains. Both of these vessel lots, though, have fracturing along coils where weakness could have developed during firing or use.

There is considerable variety in the presence of iron oxide nodules as natural inclusions in the vessel lot pastes. One grit-tempered, the mixed-tempered and one shell-tempered vessel lot have little or no iron oxide grains. Two shell-tempered lots have some of these inclusions and a grit- and a shell-tempered lot have frequent iron oxide grains. This suggests the use of different clay sources for the manufacture of the pots.

Only one of the vessel lots has rim sherds. This grit-tempered vessel is the most complete pot from the Nauset area excavations. Its squared lip is atop a very slightly everted rim which is decorated with the complex rocker dentate pattern described above. The necked vessel has an approximate 14 centimeter rim diameter below which the body becomes more rounded. No complete basal fragments were found to suggest the shape of the base.

Whereas considerable inconsistency has been noted in many of the attributes of the vessels from Concentration 341.23, there seems to be some consistency in their surface treatment. The primary technique used for both surfaces is smoothing, although the mixed-tempered vessel lot has some wiping too and the exterior of one grit-tempered lot is wiped. Two of the shell-tempered lots have smoothing over the cord-marking.

Concentration 341.23, Spatial Patterns

No positive cultural features were uncovered to assist in the functional and chronological interpretations of pottery use. Excavation Units 9, 13, and 18 contain very high lithic and bone frequencies although the lithic frequencies are not as high as in the midden area of Concentration 341.21. The large amounts of bone in conjunction with the lithics and pottery might suggest the presence of habitations and activity areas in the very near vicinity.

Concentration 341.23, Chronological Implications

This concentration has the clearest evidence for an association between temper type and the vertical depth of occurrence. The shell- and mixed-tempered sherds by weight are more prevalent in the plowzone to an average depth of 20 cm below surface. The grit-tempered sherds by weight are much more frequent in the lower depths of the plowzone and the underlying mottled soil horizon. There is the possibility that this observation is skewed by the one, large grit-tempered vessel lot found in this concentration within the lower excavation levels.

The shell-tempered vessel lots and the plowzone horizon, and grit-tempered lots and the mottled soil generally are associated over the 19BN341 site area. A possible interpretation of this data, then, is a Late Woodland occupation indicated by the cord-marked, shell-tempered vessels and associated with abundant living debris, while a hint of an Early to Middle Woodland presence is suggested by the grit-tempered, dentate pot.

The recovery of diagnostic projectile points in the area is relevant here. There is a strong suggestion of two occupation periods from these data since both Levanna points of the Late Woodland period and several types of points of the Late Archaic-Early Woodland were found. There is considerable mixing, however, of these projectile points with both Levannas and a Squibnocket stemmed point in the plowzone, Levannas in the mottled soil horizon, and a Susquehanna Broad/Wayland point in the B soil horizon. Two C-14 dates taken from small features suggerst an early Late Woodland occupation (see Chapter 8). The relationship between the dentated, grit-tempered vessel and one C-14 date (A.D. 840 +/- 110) is curious since an older age affiliation was expected.

Concentration 341.24

Concentration 341.24 is west of 341.23 located on open, level ground. A total of 417.9 g of pottery was recovered from eight adjoining excavation units (1,10,11,12,15,19,20 and 21) which vary in size and an excavation unit (14) and a shovel test (927) located about 15 m to the north. Twelve vessel lots were identified. The distinct temper and decorative attributes of the grit and mixed tempered sherds allowed all of them to be placed into lots. Sixty-two percent of the shell-tempered sherds by weight could be assigned to a vessel lot. Two grit-tempered, two mixed-tempered, and eight shell-tempered vessel lots were distinguished (Table 14.12).

Concentration 341.24, Stylistic Attributes

The variety of decoration in this concentration is somewhat greater than in the others, probably due to the larger number of vessel lots identified. The range of decorative techniques is typical for the Nauset area. Both grit-tempered vessel lots are dentate stamped with horizontal rows around the lip in one case and on the body in the other. Of the mixed-tempered lots, the decoration on one cannot be identified, the other is scallop-impressed. The decorative techniques on the shell-tempered vessel lots are: undecorated (1), dentate impressed (1), cord-wrapped stick impressed (1), and cord-marked (5). Of the three vessel lots with cord marking and an identifiable cord twist, all had a Z-twist, which is consistent with other similar vessel lots in 19BN341. No decorative motifs were identifiable on any of the vessel lots.

Concentration 341.24, Technology and Function

The frequencies of occurrence and the relationships between the presence of coil breaks and carbonized residue among the vessel lots at Concentration 341.24 is very similar to that of Concentration 341.23 (Table 14.15). One of the grit-tempered and neither of the mixed-tempered lots have evidence of coil breaks while six of the eight (75%) shell-tempered lots have numerous coil breaks. One shell-tempered lot has many sherds with the breaks on both edges so that the width of the coil is measurable. The range of widths in this lot is 5-11 mm with a mode of 9 mm. It is quite possible that the range of coil widths represents a manufacturing technique in which larger coils were used in making the vessel body, which requires greater strength, than the rim.

Carbonized residue is present on all of the grit-tempered and mixed-tempered vessel lots, but on only two of the eight shell-tempered lots. The most likely explanation for this difference is the lack of rim sherds for most of the shell-tempered lots since two of the three shell-tempered lots with coil breaks and rim sherds also have residues. At this concentration also, a cooking function for the vessels of all temper types seems likely.

Within each class of pottery temper, there is considerable consistency in the specific materials used. The temper grain sizes and density and the resulting paste texture show the greatest tendency to vary. Both grit-tempered vessel lots contain poorly sorted angular quartz and crushed granite temper but one lot consists of smaller grains in a more compact paste than the other. Similarly, both mixed-tempered vessel lots are made with poorly sorted shell and angular quartz but vary in terms of grain size and paste compactness.

The pottery tempered with shell is very consistent with that found in Concentrations 341.21, 341.23 and 273/275.31. The shell has leached out of all eight of the vessel lots but there are scallop shell impressions present among five of these lots. Two of the vessel lots consist of smaller-grained shell in a more compact paste than the others. Moffet (1957), Fowler (1966) and Ritchie (1969) linked similar temper and paste characteristics to the late part of the Late Woodland period.

The presence and frequency of iron oxide nodules as natural inclusions in the vessel lots is also consistent with the other concentrations at 19BN341. The iron oxide grains are occasionally present in the two grit-tempered vessel lots and virtually absent in the mixed-tempered lots. There is wide variability among the shell-tempered lots as to their density of occurrence. This pattern again suggests that several clay sources were probably used to construct the various pots.

A few rim sherds are present in the pottery assemblage. One grit-tempered vessel lot contains a rounded lip sherd on which a

dentate stamp was impressed. The lower portions of this rim which would assist in determining the general vessel shape and diameter are not present. Three shell-tempered vessel lots contain rim sherds. One has a 4-7 mm thick squared lip on an everted rim angled to approximately 105 degrees. The vessel diameter could not be determined from the fragments but a rare basal fragment is present indicating that the vessel had a conoidal or pointed base. The second rim sherd displays 8 mm thick rounded lip on a vertically aligned rim. The third shows a squared lip on an undetermined rim orientation. All three of these vessel lots have cord-marking over the vessel portions represented by the sherds present: lip, rim, and body.

Similar to the sherds from other concentrations at 19BN341 is the relative lack of consistency in the interior surface treatment of the vessel walls among the sherds from concentration 341.24. Smoothing and/or wiping is common among the grit- and mixed-tempererd sherds while smoothing, wiping, and scraping in various combinations is present on the shell-tempered sherds. In two cases, the scraping was done by a scallop shell. The exterior vessel wall surfaces for all temper types are usually smoothed with decoration or cord-marking over it.

Concentration 341.24, Spatial Pattern

Like those in Concentration 341.23, the excavation units in Concentration 341.24 have high densities of lithic materials and abundant bone. The evidence seems to be strong, especially in conjunction with the pottery, that the deposits represent multiple activities.

Two small features were excavated; both predominantly contained shell debris but in one there was a high density of lithics and bone as well. Neither feature contained much pottery although several larger sherds were found in Feature 1 of Excavation Unit 15. The sherds were cord-marked and have been assigned to two different shell-tempered vessel lots. Usually the exclusively shell-tempered sherds from both features are so tiny that no observations can be attempted. Unless these features were severely truncated by plowing or the like, it is unlikely that pottery debris made up a significant portion of these features.

Concentration 341.24 Chronological Implications

Although pottery sherds of all three temper types are scattered through the plowzone and mottled soil horizons, there does seem to be a tendency for more of the grit- and mixed-tempered sherds to be in the mottled soil horizon in at least one Excavation Unit. This is, however, very scanty evidence with which to comment on chronology.

The diagnostic projectile points recovered from the concentration support the observations from the other concentrations that two occupational components are represented. Numerous Levanna points were found as well as several types typical of the late Archaic period. The Levannas were found in all excavation levels and the other points came predominantly from the plowzone suggesting substantial mixing. Four C-14 dates were done from feature contexts in the concentration. Three of the four dates support a Late Woodland occupation probably contemporaneous with the other concentrations discussed. One date (A.D. 860 +/- 155) comes from the feature containing cord-marked, shell-tempered sherds. The fourth date is somewhat earlier in and is discussed in Chapter 8.

19BN341, Site Summary

Some general observations and comments can be made concerning the pottery from all the concentrations at 19BN341. A total of twenty-eight pottery vessel lots have been identified, including seven grit-tempered, 17 shell-tempered, and four mixed-tempered lots. Concentrations 341.21, 341.23, and 341.24 all have approximately the same number of identified vessel lots proportionate to the number of excavation units dug. There is the possibility that the number of lots is inflated if, as noted by Byers and Johnson (1940:62), considerable heterogeneity of temper type, size, density, paste texture, and body wall thickness was common. It is impossible to check for this potential internal variation in a vessel lot when only a few, small fragments are available.

The variation in decorative techniques and motifs over the site area is not great. Cord-marking is the predominant surface finish for the shell-tempered vessels while dentate stamp is the most frequent decorative technique for grit- and shell-temper types. There is little variety of decorative motif with horizontal and vertical parallel lines predominating. These patterns are fairly consistent across the concentrations which suggests cultural homogeneity and contemporaneity. Concentration 341.23 has the least decorative variation.

The predominance of one type of surface finish (cord-marking) and the small amount of variety of decoration and motif in conjunction with a number of technological attributes all suggest the primary function was for cooking. All of the grit- and mixed-tempered vessel lots have some residue on the sherds while 41% (7/17) of the shell-tempered vessel lots have this feature. Byers and Johnson (1940:68) noted the prevalence of carbon residues in their extensive discussion of the pottery from two Martha's Vineyard sites.

Possibly related to a cooking function of the vessels is the high frequency of coil breaks within the lots, which may be due to thermal stresses incurred during repeated episodes of heat.

Overall, 50% of the grit-tempered, 69% of the shell-tempered, and 25% of the mixed-tempered lots have evidence of coil breaks. These figures suggest that expedient, nonspecialized manufacturing techniques were practiced by local potters resulting in pots that could not adequately withstand the thermal stresses produced during their cooking function. A technological attribute of great consistency over the site area, present in other sites (e.g.,Byers and Johnson 1940:60), and potentially beneficial for reducing the effects of thermal stress is the use of scallop shell as a tempering material. Unfortunately, the manufacturing practices of not sorting the temper or the iron oxide natural inclusions for a homogeneous grain size and the poor attempts at bonding the coils seem to have countered the positive effects of scallop shell temper use.

Pottery is associated with several cultural features over the site area. There is a clear relationship between the presence of pottery and large dense refuse areas, such as the shell midden in Concentration 341.21. Pottery is not substantially present, however, in the small pit features filled with shell. These features may represent one dumping episode in contrast with the middens in which a variety of debris probably accumulated and spread out over a period of time. It also is likely that the particular concentrations of pottery over the site area are near domestic activity areas where cooking occurred.

The three temper types of pottery are present in both the plowzone and mottled soil horizons over the site due to plowing. This kind of disturbance prevents any rigorous testof the commonly accepted association of grit-temper with the Early Woodland and shell-tempered pots with Late Woodland occupations (Moffett 1957). When the predominant proportion of each vessel lot is associated with a soil horizon within all the excavation units, however, there is a strong tendency for the shell-tempered lots to be situated in the plowzone and the grit-tempered lots in the mottled soil horizon. All of the concentrations also have a number of diagnostic projectile points which have clear Late Woodland and Late Archaic/Early Woodland associations. The Levanna points, however, are more frequent than the other point types. This seems to be consistent with the higher frequency of shell-tempered pots at 19BN341 and the C-14 dates. Both of these data suggest a Late Woodland occupation dominated the site area and may have severely obscured earlier occupations, which probably were smaller or less intensive anyway (see Chapter 5).

South Side of Salt Pond Summary of the Prehistoric Pottery Remains

The majority of the pottery sherds by weight and the vessel lots by count recovered from the sites immediately south of Salt

Pond (19BN273/275, 274/339, 340, and 341) are shell-tempered. Grit- and mixed-tempered sherds are not prevalent at any of the sites and were absent from the excavations at 19BN274/339 and 19BN340. The overhwelming use of shell-tempered pottery at these sites suggests chronological as well as cultural and spatial associations that will be elucidated below. The stylistic and technological/functional attributes also have important implications to be discussed.

The vessel lots identified at 19BN274/339 are unique in terms of the variety of decorative techniques employed on one vessel and the overall similarity of the decorative motifs chosen for most of the vessels. The strong association of this stylistic configuration with primarily Middle Woodland projectile points helps to isolate the pottery as different from that at other sites. Although the triangle and oblique lines used as the basis for the motifs at this site are similar to other sites in the general Nauset area, it contrasts with the primary emphasis on cord-marking and dentate stamp in horizontal or vertical lines at the nearby sites. Sites 19BN273/275 and 19BN341 are very similar in the range and type of decorative techniques found on the pottery suggesting chronological and/or cultural similarity.

Despite stylistic differences among the sites, there seems to be some consistency in the morphological characteristics of the vessels. All of the lip or rim sherds have squared or rounded lips on a basically vertical or somewhat everted rim. The mouth diameters of the pots vary between 10 and 14 cm. One shell-tempered vessel lot from 19-BN-341 contains a basal fragment which is conoidal but there is no other evidence of basal shape at the sites.

A consistently nonspecialized, expedient manufacturing technique seems to have been practiced at the sites. This involved: (1) not refining the clay of its iron oxide nodules, (2) not selecting a standard temper grain size for greater body strength, and (3) forming thin coils which were often weakly bonded together. These characteristics are apparent among the vessel lots of all three temper types although the frequencies of lots with coil breaks vary by site. There seems, then, to be some evidence that a basic production technique and standard was developed and maintained in the area, and used despite the choice of temper.

The wide range of iron oxide nodules in the vessels' pastes at the sites further suggests that clays were mined from more than one place or more than a single stratum within a clay deposit. It is quite possible that the potters gathered clay from whatever source was nearest at hand. This hypothesis in conjunction with the evidence of a relatively low standard of manufacture strongly suggests that pottery construction in this area was done expediently as a periodic household craft. Individuals of varying talents but using the same basic production steps are also suggested by the varying degrees of

technological consistency. For example, one manufacturing consistency of note is the use of scallop shell as the primary tempering ingredient. The potential benefits from its use would support the development and maintenance of the manufacturing tradition. Since little or no scallop shell was recovered among the shellfish remains in the excavations at the sites, it is probable that the scallop shell was consciously selected and sought after for use in pottery making. How the tempered clay was then formed into a pot would then vary along other dimensions.

It is evident from the discussions by concentration that the pottery is localized on most sites. 19BN341 is the only site with pottery in the majority of the concentrations. Since much of pottery failure occurs during use (David 1972; DeBoer and Lothrop 1979), this localization of the pottery might suggest that the vessels functioned in one primary context,or were deposited in one secondary trash dump,instead of many locations over a site area. The association of a carbonized residue on the interior rim and body sherds of all three temper types, except at 19BN274/339 where no residues were visible, and the breakdown of the vessels along the coil junctions, possibly due to thermal stresses, both support a cooking function for the vessels. It is expected, therefore, that the primary function of the vessels would identify their recovery context as areas of cooking activities, areas around hearths, or refuse deposits. In fact, the principal locations of pottery recovery are in concentrations with high densities of fire-cracked rock at 19BN273/275 and 19BN274/339, in a midden concentration 341.21, and possibly in the immediate vicinity of domestic activity areas at 341.23 and 341.24.

Many of the stylistic and technological attributes of the pottery from 19BN341 and 19BN273/275 suggest that the sites areas were occupied contemporaneously or sequentially over a long period of time. No diagnostic artifacts were recovered from 19BN273/275 to assist in determining contemporaneity and those at 19BN341 suggest mainly a Late Woodland period of occupation. In addition, because of soil and artifact mixing at both sites, it is difficult to assess the association of temper type with time period. The stylistic attributes of the pottery in combination with the diagnostic projectile points recovered from 19BN274/339 and the C-14 dates implies that the site was occupied at a different time than the other two. The single sherd from 19BN340 does not offer much material with which to assign it a temporal affiliation. The very low frequency of pipes at these sites suggests either their long curation as objects of value or their infrequent production and use. Other Cape Cod sites excavated by Moffett reveal similarly low frequencies of pipes, although several were found at the Mattaquason Purchase site in North Chatham (Eteson et al. 1978). Neither of the pipe fragments from the southern side of Salt Pond is decorated so that no stylistic comparisons can be made with the pottery.

Prehistoric Ceramics, Northern Side of Salt Pond and Nauset Marsh

19BN288

The site area 19BN288 (Fold-out Map C) is very large and has a history of post-depositional disturbance from agriculture and the construction and use of a golf course. Although the total weight of pottery found over the site is small, 129.4 g, its spatial distribution is extensive. This distribution is concentrated in specific areas over the site. Given the results of the tests on the relationships between the presence of pottery, high density artifact and refuse areas, and the meaning of pottery found in shovel tests, these areas of pottery concentrations might indicate a series of spatially dispersed dense refuse deposits (see Chapter 13).

Pottery is found both in excavation units and shovel tests in 17 of 24 identified concentrations located in several topographically distinct areas (Table 14.13). There is a general tendency, however, for the majority of the pottery to be located along the ridge and on its slopes overlooking Nauset Bay. With increasing distance inland from the ridge, there is a lower frequency of pottery.

Fourteen vessel lots were identified over the site, including three grit-tempered, three mixed-tempered, and eight shell-tempered lots. These represent 55.4% of all the sherds recovered. Only 44.0% of the shell-tempered sherds could be so placed primarily because of tiny sherd size (Table 14.1). All of the grit-tempered sherds and 84.3% of the mixed-tempered sherds could be given vessel lot designations since there were fewer sherds and it was easier to determine attribute differences.

19BN288, Stylistic Attributes

The decorative techniques used on the vessel lots show considerable regularity over the site area (Table 14.14). The predominant surface treatment is cordmarking on the shell and mixed tempered vessel lots. The few decorative techniques distinguishable on the sherds are the use of cordage for fabric impressions and cord wrapped stick impressions. The fabricic-impressed vessel lot was recovered in Concentration 288.21 and the fabric utilized for the decoration may have been a net since a crosshatch pattern was formed. Dentate stamp is a decorative technique often found on both shell- and grit-tempered pottery on the Outer Cape though not with great frequency on any site. Two dentate stamped pots found at the site came from Concentration 288.42. The grit-tempered rim sherds display a series of parallel diagonal lines across the lip and rim and the shell-tempered sherds have parallel horizontal rows. There is faint evidence of cordmarking on a grit-temperd sherd recovered

TABLE 14.13

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN288

Concentration	Number of shovel test pits: with pottery	Number of shovel test pits: without pottery	Number of excavation units: with pottery	Number of excavation units: without pottery	GRIT: Undecorated	GRIT: Spalled	GRIT: Undetermined	GRIT: Cordmarked	GRIT: Dentate	GRIT: Complex Dentate	GRIT: Incised	GRIT: Cordwrap Stick	GRIT: Fabric Impressed	GRIT: Combed	GRIT: Scallop	GRIT: TOTAL WEIGHT	SHELL: Undecorated	SHELL: Spalled	SHELL: Undetermined	SHELL: Cordmarked	SHELL: Dentate	SHELL: Complex Dentate	SHELL: Incised	SHELL: Cordwrap Stick	SHELL: Fabric Impressed	SHELL: Combed	SHELL: Scallop	SHELL: TOTAL WEIGHT	MIXED: Undecorated	MIXED: Spalled	MIXED: Undetermined	MIXED: Cordmarked	MIXED: Dentate	MIXED: Complex Dentate	MIXED: Incised	MIXED: Cordwrap Stick	MIXED: Fabric Impressed	MIXED: Combed	MIXED: Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	13	2	0												0		3		1								1.9	3	1										0.4	2.3
21	1	10	1	0														5	2						1			3.4		3										0.9	4.3
22	1	12	0	0														2										0.4												0.2	0.6
23	1	4	0	0													1											0.4	1												0.4
31	1	11	1	0													3	9	1	1				1				24.0													24.0
32	0	9	0	0																																				
33	0	5	1	0													1		1									1.4													1.4
34	0	5	0	0																																				
41	1	4	1	0														10										2.7													2.7
42	0	2	2	0				2								10.9		4	23	4	2							11.3													11.3
43	1	5	0	0														1										0.5													0.5
44	0	7	0	0																																				
45	5	4	0	0													3	3	2									4.2													4.2
51	1	8	1	0													1							1				0.2								1					6.4
52	0	3	4	0													18	68	2	3			1					42.2		1										1.2	43.4
53	2	2	1	0				1								2.3	1	9										3.0													5.3
54	2	5	0	0			1									2.1		1										0.2													2.3
55	6	6	0	0														2	2	1								1.8												0.1	1.9
56	0	4	0	0																								0.6													0.6
57	1	5	0	1														1	2																						
58	0	6	0	0																																				
61	0	6	0	0																																				
62	0	10	0	0																																				
63	1	9	0	1														1	1									0.5													0.5
TOTAL																15.3												98.7												15.4	129.4

from Concentratiion 288.53 located somewhat inland from the major pottery yielding concentrations. This sherd may be Vinette 1 and represent an Early Woodland occupation.

19BN288, Technology and Function

The high frequency of lots with coil breaks is similar to Site 19BN341 on the southern side of Salt Pond, yet they differ in the lack of carbonized residues at this site. There is a strong association of pottery and firecracked rock over the site suggesting pottery's primary use in cooking, but little evidence of residues.

Two other observations of technological note at the site are the presence of a coil fragment and the use of burned quahog temper. The coil fragment is untempered and its presence strongly suggests local pottery manufacture, either in Concentration 288.52 where it was found or nearby. The thickness of the coil is 6-7 mm which is slightly thinner than the average 7-9 mm thickness measured on shell-tempered sherds with coil breaks on two sides. It is unclear why the coil fragment is untempered unless it was intended for making a pipe. The small fragment of pipe stem also recovered from Concentration 288.52 affirms the use and probable manufacture of pipes at the site. This pipe fragmnent also is another case in the Nauset Bay area of one or two pipe sherds recovered per site. The very low frequency of pipes on these sites suggests infrequent or specialized use, and long term curation of pipes.

The benefits of using burned shell for tempering material have been discussed in Chapter 13 and may represent the expedient use of available materials. Burned shell is often found in association with hearths and middens so would have been readily available and obviously easier to process. Considering the massive thickness of quahog shell, burning it would render it much easier to break up and mix into the clay.

19BN288, Spatial Pattern

More than one vessel lot was identified in Concentrations 288.21, 288.42, and 288.52. The latter two concentrations clearly represent dense deposits of remains and possible multiple activity areas (Table 14.14). Equally important are the clusters of shovel tests containing sherds that could not be assigned to a vessel lot, but suggest the extensive use and possible manufacture of pottery. In combination with the location of the vessel lot groups, the pottery-bearing shovel test clusters reveal four areas where a number of activities including pottery use or deposition probably occurred in the Late Woodland period. These include: an area within Concentration 288.31 in the northern portion of the site, the midden in Concentration 288.42, the cluster involving Concentrations 288.45, 288.52, 288.53, and

TABLE 14.14

Vessel Lot Attributes from 19BN288

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
11	9	1	2	S		X									X		spalled	1.4
21	5	1	3	M										X		X	spalled	0.9
	11	1	2	S				X							X		9	2.0
31	10	1	11	S						X							6-8	16.3
41/42	6	3	9	M	X										X		spalled	5.8
42	1	2	2	G			X										7-9	10.9
	7	3	4	S		X									X		spalled	2.1
	8	1	2	S			X								X		7	1.6
51	4	2	10	M		X									X		6-7	6.1
52	12	2	20	S		X			X						X		7	13.8
	13	3	3	S		X											6-7	2.4
	14	2	2	S										X	X		9-10	3.9
53	3	1	1	G		?									X		7-9	2.3
54	2	1	1	G										X	X		7-8	2.1

the eastern half of 288.55. The localized area that includes portions of 288.53 and 288.54 where grit-tempered sherds were recovered might represent an earlier occupation.

19BN288, Chronological Implications

Chronological information is difficult to derive from the pottery remains because they are so fragmentary and each concentration has relatively few vessel lots. In Concentration 288.42, grit-tempered sherds were stratigraphically higher than the shell-tempered ones reversing the traditional notion (Moffett 1957) that the use of grit temper preceded shell temper in time.

Concentration 288.52 contained exclusively shell-tempered, predominantly cordmarked pottery suggesting a Late Woodland period of occupation. The presence of a possible Squibnocket Triangle point and a Levanna fragment within the concentration helps only to show that several periods of occupation may have occurred. The high proportion of shell-tempered pottery within this concentation and over the site in general, however, implies a longer or more concentrated occupation during the Late Woodland.

In Concentrations 288.53 and .54 the localized presence of grit-tempered sherds in an area of the site where artifact densities begin to decline in frequency is interesting. It might indicate the remnants of a small, Early or Middle Woodland occupation situated in a low-lying area protected from the wind and near a possible water source. This location differs from that chosen by Late Woodland people up on the ridge overlooking Nauset Bay.

19BN390

The site area is situated along the edge of Nauset Marsh West of 19BN288 (Foldout Map F). Post-depositional disturbance has occurred from early historic plowing and landscaping for a 20th century golf course. Within the central block of excavation units, an undisturbed cultural layer was excavated from which the majority of pottery sherds and identifiable vessel lots were found.

The total weight of pottery excavated from the site is relatively large, 365.2 g, considering the number of excavation units dug. The majority of pottery was recovered from concentration 390.33 in which a block excavation was dug (Table 14.15). Overall, both excavation units and shovel test pits yielded pottery in five of the twelve identified concentrations. Eleven vessel lots are identified from three of the concentration areas including six grit-tempered, three shell-tempered, and two mixed-tempered lots (Table 14.16). These vessel lots represent only 56.9% of all the sherds recovered since large proportions of

TABLE 14.15

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN390

Concentration	Number of shovel test pits		Number of excavation units		GRIT												SHELL												MIXED													
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	6	0	0																																					
12	0	7	0	0																																					
21	0	9	0	0																																					
22	0	13	0	1																																					
23	1	3	0	0																									1	1										1.9	1.9
31	1	11	0	0													1											0.5												0.5
32	0	7	0	0																																					
33	1	6	5	0	105	260	4		17	4			8		2	149.5	40	93	7	4								56.8	75	118	6					8				135.8	342.1
34	0	7	1	0	4											15.1	1	2	3	1								2.3													17.4
35	0	11	1	0	4	1								1		2.7		2										0.4	1											0.2	3.3
36	0	9	0	0																																					
37	0	9	0	1																																					
TOTAL																167.3												60.0												137.9	365.2

the grit and shell tempered sherds could not be assigned to any lot. Site 19BN390 is unique within the Nauset Bay region due to its high frequencies of grit and mixed tempered sherds (Table 14.1).

19BN390, Stylistic Attributes

There is a marked differentiation in decorative techniques between the different temper types among the vessel lots (Table 14.16). The shell- and mixed-tempered lots tend to be cord marked or be decorated with a cord wrapped stick, while the grit-tempered vessel lots have a wider variety of decorative techniques such as rocker dentate, scallop and fabric impressed. All three temper types include at least one vessel lot which is undecorated. It is unlikely that the original vessels had absolutely no surface treatment or decoration, rather they probably were decorated only around the neck and rim and these sherds were not recovered.

None of the vessel lots are large enough to adequately discern decorative motifs. The general tendency in the application of the decoration, however, is in a simple horizontal or vertical manner. This is very typical of the Nauset Bay area and the outer Cape in general.

19BN390, Technology and Function

One vessel lot for each of the three temper types has evidence of breaking along the coils (Table 14.16). The proportion of grit-tempered vessels with coil breaks is much smaller (17%) than for the other temper types suggesting that they were made with a better bonding technique. Two of the six grit-tempered vessels, however, have attributes that suggest great care was not always taken during manufacture. One lot has several vertical cracks along the rim which often occurs when a pot is made with too much temper and the clay is too dry. Another lot consists of only two sherds both of which have the consistency of compacted mud. The use of angular quartz and granite as temper was the primary attribute used to label these artifacts as pottery.

Of all the vessel lots, only two grit-tempered lots have a carbonized residue on the interiors. Both of these lots are decorated with a dentate stamp and only one has any evidence of breaking along a coil. Both of these lots were excavated from the area around a possible hearth feature.

Within each temper type there is fairly good consistency in the materials added to the clay. Angular quartz and crushed granite were usually added together or occasionally separately to make the grit-tempered pots while scallop and soft shell or quahog were used for the shell- and mixed-tempered vessels,

TABLE 14.16

Vessel Lot Attributes from 19BN390

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration											Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined	Coil breaks	Carbon residue	
33	2	3	6	G							X					X	8-10	18.3
	3	4	10	G				X									6-9	15.3
	4	1	2	G									X				7	2.1
	6	1	2	S		X											5-7	4.8
	7	1	2	S													6	2.5
	8	2	10	S	X										X		6-8	8.9
	9	4	9	M						X							6-7	12.9
	10	9	106	M	X										X		8	83.4
	11	10	246	G			X								X	X	6-8	44.6
34	1	2	4	G	X												11-12	14.7
35	5	1	1	G	X												5	0.4

the grit and shell tempered sherds could not be assigned to any lot. Site 19BN390 is unique within the Nauset Bay region due to its high frequencies of grit and mixed tempered sherds (Table 14.1).

19BN390, Stylistic Attributes

There is a marked differentiation in decorative techniques between the different temper types among the vessel lots (Table 14.16). The shell- and mixed-tempered lots tend to be cord marked or be decorated with a cord wrapped stick, while the grit-tempered vessel lots have a wider variety of decorative techniques such as rocker dentate, scallop and fabric impressed. All three temper types include at least one vessel lot which is undecorated. It is unlikely that the original vessels had absolutely no surface treatment or decoration, rather they probably were decorated only around the neck and rim and these sherds were not recovered.

None of the vessel lots are large enough to adequately discern decorative motifs. The general tendency in the application of the decoration, however, is in a simple horizontal or vertical manner. This is very typical of the Nauset Bay area and the outer Cape in general.

19BN390, Technology and Function

One vessel lot for each of the three temper types has evidence of breaking along the coils (Table 14.16). The proportion of grit-tempered vessels with coil breaks is much smaller (17%) than for the other temper types suggesting that they were made with a better bonding technique. Two of the six grit-tempered vessels, however, have attributes that suggest great care was not always taken during manufacture. One lot has several vertical cracks along the rim which often occurs when a pot is made with too much temper and the clay is too dry. Another lot consists of only two sherds both of which have the consistency of compacted mud. The use of angular quartz and granite as temper was the primary attribute used to label these artifacts as pottery.

Of all the vessel lots, only two grit-tempered lots have a carbonized residue on the interiors. Both of these lots are decorated with a dentate stamp and only one has any evidence of breaking along a coil. Both of these lots were excavated from the area around a possible hearth feature.

Within each temper type there is fairly good consistency in the materials added to the clay. Angular quartz and crushed granite were usually added together or occasionally separately to make the grit-tempered pots while scallop and soft shell or quahog were used for the shell- and mixed-tempered vessels,

respectively. Rounded sand grains are visible on the surface of some of the shell-tempered lots which were possibly imbedded in the clay during vessel formation. These are distinguished from the angular and rounded quartz grains in the mixed-tempered lots since the latter are more evenly distributed in the clay and the angular grains suggest purposeful addition. Some of the shell-tempered sherds seem to have had the shell burned prior to addition to the clay.

Four of the grit-tempered lots have sherds with discernible lip profiles although only one lot includes a whole rim. All of the vessel lips are a variation on a flat or squared profile with two having a tapered flat top and one having a slight overhang from the wall edge. The one discernible rim profile is basically vertical with a slight outward flare from the neck which is pinched inward slightly. This rim profile is very similar to another rocker dentate decorated vessel from site 19BN341 located to the south on the other side of Salt Pond.

Two other observations of technological attributes include wall thickness and wall surface treatment. There is a tendency for the grit-tempered lots to have thicker walls especially among the body sherds (8-12mm.) while the shell and mixed tempered vessel lots have thinner walls (5-8mm.). One well represented grit-tempered vessel, however, has thinner walls of 4-6mm. After the walls were built up and slightly dried, the grit-tempered vessels were always smoothed on the interior and exterior surfaces. This practice served to push the irregular inclusions into the clay to provide a better surface for decoration. The shell-tempered vessel lots often have interior scraping although a smoothed or wiped interior is present on some shell and mixed tempered vessel lots.

19BN390, Spatial Pattern

The block excavation yielded several shell features and a large burned area interpreted as a possible hearth. No pottery was recovered from the shell features but a large amount came from near and within the burned area labeled a feature. In fact, 31.5% of all the pottery recovered from the site was from this area. Two vessel lots came directly from it: a dentate stamped, grit-tempered lot and an undecorated, mixed-tempered lot. The former lot has carbonized residue which strongly suggests a cooking function and both have coil breaks which may have resulted from thermal stress during use. Other grit- and mixed-tempered vessel lots are identified from sherds recovered in the undisturbed cultural level around the burned area. None of the shell-tempered lots can be positively associated with the hearth area or the undisturbed cultural level.

19BN390, Chronological Implications

The decorative techniques and the temper material used during the manufacture of the pottery vessels at 19BN390 minimally suggest an Early-Middle Woodland occupation with a possible brief Late Woodland occupation. Rocker dentate, scallop impressions, and cord wrap stick have all been associated with the Middle Woodland period. The Cunningham site on Martha's Vineyard (Ritchie 1969) has all of these decorative techniques on sherds from a level dated to A.D. 400+/-80 as well as cord marked, shell tempered pottery. Similarly, the presence of both grit and shell (or mixed) tempered pottery occurred at Cunningham as it does at 19BN390.

The diagnostic lithic artifacts from 19BN390 strongly suggest an early occupation including a Squibnocket stemmed, a possible Susquehanna broadspear, an Orient Fishtail, and a Rossville point. Although these suggest an earlier presence than the Middle Woodland, the local pottery and projectile point associations have yet to be adequately worked out. A single Squibnocket Stemmed point was found in the vicinity of the block excavation which helps support a Late Archaic/Early Woodland presence at the site. Two C-14 dates (see Chapter 8) support both Middle Woodland (A.D. 350 $\pm$ 130) and Late Archaic occupations (1365 + 145 B.C.).

19BN333/336/337

Three sites were designated and tested on the north side of Nauset Bay but will be considered together here due to their close spatial proximity and the similarities in the pottery (Foldout Map G). All three sites have been disturbed in the historic period resulting mostly from the construction and use of a private golf course and a paved road. 19BN333 is located closest to the Bay along an eroding cliff in an area where known pothunting has been prevalent, and the other two are located slightly inland from it.

The total weight of pottery recovered from the three sites is very small, (22.3 g with 19BN336 contributing the most, 12.0 g; Table 14.17). Sherds were retrieved from only the excavation units so that in two of the seven concentrations, where only shovel test pits occurred in the concentrations, no pottery was found. Eleven vessel lots are identified from five concentrations and include five grit-tempered, one mixed-tempered, and five shell-tempered lots. There is scanty evidence to describe these lots (Table 14.18), so that this number could be too high. These vessel lots comprise 93.7% of the total sherds found since all of the grit-tempered sherds and most of the others could be assigned to a lot (Table 14.1).

TABLE 14.17

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN333/336/337

Concentration	Number of shovel test pits		Number of excavation units		GRIT												SHELL												MIXED													
	with Pottery	without Pottery	with Pottery	without Pottery	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	Undecorated	Spalled	Undetermined	Cordmarked	Dentate	Complex Dentate	Incised	Cordwrap Stick	Fabric Impressed	Combed	Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
333 .11	0	4	2	1	1											0.5	2	8	2									3.8													4.3
333 .12	0	4	0	0																																					
336 .11	0	5	1	0			1									0.7	4	5	2	1								4.4													5.1
336 .12	0	2	3	0	1	3										1.5	2	5	1	2				1				5.4													6.9
336 .13	0	3	0	0																																					
336 .14	0	3	4	0													2	1	2					1				2.3													2.3
337 .11	0	3	4	1			1									0.3														7		2								3.4	3.7
TOTAL																3.0												15.9												3.4	22.3

19BN333/336/337, Stylistic Attributes

The very small and fragmented condition of the grit-tempered sherds made it impossible to determine what, if any, decorative technique was used on three of the vessels. Two appear to be undecorated. although these vessel lots consist of only one sherd in each case.

Two shell-tempered and one mixed-tempered vessel lots have cordmarking on their exterior wall surfaces. A cord wrapped stick was used on one shell-tempered vessel while the other two shell-tempered lots have an undetermined surface treatment or decoration.

19BN333/336/337, Technology, Function, and Chronological Implications

Again, because of the small and spalled nature of the sherds, few definitive statements can be made about the technological history of these vessel lots. It is evident from Table 14.18, however, that four of the five (80%) shell-tempered lots have broken along the coil junctions. Although this is a particularly high percentage, this phenomenon is very common among the shell-tempered vessels in the Nauset area. Only one of the grit-tempered lots has any sign of breaking along a coil. None of the vessel lots of any temper type has any carbonized residue to indicate use during cooking. One cordmarked, shell-tempered lot does have a blackened interior wall suggestive of cooking use.

The inclusions purposely added to the clays vary somewhat in the grit category. Angular quartz is present in three vessel lots, along with crushed granite in the other two lots. Of interest is the probable inclusion of organic material in one of the quartz/granite tempered vessels. This material has disintegrated and it is unknown whether it was purposely added to the clay or not. The only other known occurrence of grit and organics in a sizeable amount in a pottery vessel is from site 19BN471 along the Herring River in Wellfleet.

The relatively thin walls of the shell-tempered lots suggest that they might date to the later Late Woodland period (Moffett 1957). Since all of the grit-tempered sherds are spalled, no determination of their wall thickness can be made.

Using the traditional view that the presence of grit-tempered pottery indicates an Early or Middle Woodland occupation and the strong presence of cordmarked, shell-tempered lots is suggestive of a Late Woodland occupation, two components may be indicated. Very few diagnostic lithics were recovered, but a Squibnocket, a Fox Creek, and a Levanna point were found in Concentration 336.11. These artifacts also suggest two periods of occupation.

TABLE 14.18

Vessel Lot Attributes from 19BN333/336/338

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
333.11	1	1	1	G	X												spalled	0.5
	2	5	12	S										X	X		spalled	3.8
336.11	3	1	1	G										X	X		5-6	0.7
	4	3	9	S		X									X		8	3.4
	7	1	3	S	X										X		4	1.1
336.12	1	1	3	G										X			spalled	1.2
	2	1	1	G	X												spalled	0.3
	5	6	9	S		X									X		6-7	5.0
336.14	6	2	3	S						X							5	1.6
337.11	1	1	1	G										X			spalled	0.3
	2	4	7	M		X											8	3.0

Prehistoric Ceramics, Coast Guard Beach Area

19BN374

This point of land is situated at the northeastern corner of Nauset Bay and at present fronts the ocean directly. Extensive disturbance to Site 19BN374 has been caused by the Coast Guard during the construction of their facilities and by the National Park Service when providing parking, roads and paths for Seashore visitors. The infrequency and sporadic distribution of the prehistoric pottery recovered might be influenced by these factors.

The total weight of the excavated pottery is very small, 73.9 g, considering the large area tested with shovel tests and excavation units. Sherds actually were found in only two of 190 shovel tests over the whole site, but were retrieved from 25 of 73 excavation units within seven out of 26 delineated concentrations (Foldout Map H; Table 14.19). Eleven vessel lots and one pipe have been identified from six of the presently known concentrations and include four grit-tempered and seven shell-tempered vessel lots. These lots represent 88.5% of all the sherds recovered since all of the grit- and mixed-tempered sherds and 85% of the shell-tempered sherds could be assigned to lots (Table 14.1).

19BN374, Stylistic Attributes

Of the four grit-tempered vessel lots, the decorative technique used on two of them could not be determined due to exterior surface spalling. The other two are incised and dentate stamped. The decorative motifs for these two lots seem to be simple diagonal and horizontal parallel rows respectively.

The majority of the shell-tempered lots are cordmarked (Table 14.20); however, in one case, there is the unique addition of a horizontal row of triangular punctate bordering the cordmarking. Another shell-tempered vessel 10t includes two decorative techniques, dentate stamping and combing applied in horizontal parallel rows. The fabric-impressions on another lot reveal a cross-hatched pattern similar to a shell-tempered vessel found in Concentration 308.71.

The two small fragments of untempered pipe bowl in Concentration 374.21 are probably from one pipe. It is very finely and elaborately decorated by incising, a technique used on some of the other pipes in the Nauset area. The motif is unique among the survey ceramic recoveries, consisting of parallel rows of fine incisions that enclose in a square a very broad X.

TABLE 14.19

Locations of Pottery Sherds and their Frequency by Decorative Technique at 19BN374
(*=inclusion of 1982 field data)

Concentration	Number of shovel test pits: with Pottery	Number of shovel test pits: without Pottery	Number of excavation units: with Pottery	Number of excavation units: without Pottery	GRIT: Undecorated	GRIT: Spalled	GRIT: Undetermined	GRIT: Cordmarked	GRIT: Dentate	GRIT: Complex Dentate	GRIT: Incised	GRIT: Cordwrap Stick	GRIT: Fabric Impressed	GRIT: Combed	GRIT: Scallop	GRIT: TOTAL WEIGHT	SHELL: Undecorated	SHELL: Spalled	SHELL: Undetermined	SHELL: Cordmarked	SHELL: Dentate	SHELL: Complex Dentate	SHELL: Incised	SHELL: Cordwrap Stick	SHELL: Fabric Impressed	SHELL: Combed	SHELL: Scallop	SHELL: TOTAL WEIGHT	MIXED: Undecorated	MIXED: Spalled	MIXED: Undetermined	MIXED: Cordmarked	MIXED: Dentate	MIXED: Complex Dentate	MIXED: Incised	MIXED: Cordwrap Stick	MIXED: Fabric Impressed	MIXED: Combed	MIXED: Scallop	TOTAL WEIGHT	GRAND TOTAL WEIGHT (g)
11	0	0	0	4																																			
*21	0	10	6	21		1												6		1								3.9												4.4
22	0	3																																						
23	0	9																																						
24	0	5	1	0														9		6								5.1												5.1
32	0	6																																						
41	0	7																																						
42	0	6																																						
*43	0	5	4	8														11	4	1	1				1	2		16.5												16.5
*44	0	12	5	7														2	10	7					1			26.0	1											26.0
45	0	12	0	4																																				
46	0	13	4	0					2	1						4.4		2	2	2								8.8												8.8
47	0	6																																						
51	0	8	0	1																																				
52	0	11																																						
53	0	3																																						
54	0	7	1	3												0.5		1										0.5												0.5
55	0	10																																						
56	0	8																																						
57	0	3																																						
61	0	7																																						
62	0	9																																						
63	0	10																																						
71	0	10																																						
81	0	8																																						
*00	2	0	4	0		3												1	1	1								1.5												1.5
TOTAL																4.4												62.3												73.9

19BN374, Technology and Function

As is typical in the Nauset Bay area, several of the shell-tempered lots (43%) show signs of breaking along coil junctures (Table 14.20). One of these breaks is on an angle which may have been formed by paddling or pressing down on the clay to create a good bond between the coils. It is possible that no such evidence is present for the grit-tempered lots since so few sherds were found. Of greater interest is the fact that five of the seven (71%) shell-tempered lots have carbonized residues on the interior surfaces and another of these lots has a blackened interior. One of the grit-tempered lots also has a blackened interior. This evidence strongly supports the interpretation that the primary use of pottery vessels was for cooking.

There is fairly good consistency in the kinds of nonplastic inclusions chosen to temper the pots at the site, as was found throughout the Nauset Bay area. Granite, either alone or with angular quartz, was predominantly used in the grit-tempered pots while evidence of scallop shell inclusions is found in 57% of the shell-tempered lots. One of these lots, however, also seems to contain some quahog shell along with the scallop. The pipe bowl sherds are not tempered, which is also consistent with other pipes found in the area.

Only two of the eleven vessel lots have lip/rim sherds. Although one lot is grit-tempered and the other is shell-tempered, both have square lips which is very common in the area. The only vessel with an identifiable rim is a small bowl with an outwardly angled rim. The frequency of small vessels found on the outer Cape is very low with only one other recovered at 19BN274/339 from the Nauset Bay region. The vessel in Concentration 374.44 is cordmarked and has a blackened interior suggestive of use in activities related to cooking.

Overall, the vessel lots recovered at 19BN374 are well-made, fairly hard, and tend to have greater uniformity in temper size for the majority of grains than at other sites in the area. In particular, the vessel walls are quite thin. It is evident among the shell-tempered lots that the potter(s) attempted to thin the walls by scraping or wiping the interior surface of four vessels. The success of this procedure must be questioned since those vessels still have a large range of variation in the wall thickness. Curiously, the interior of the pipe bowl also is scraped finely.

19BN374, Chronological Associations

A combination of the spatial distribution of the pottery sherds, the decorative techniques, and the associated diagnostic lithic artifacts helps to place the different parts of the site area in a time frame.

TABLE 14.20

Vessel Lot Attributes from 19BN374

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper .Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
21	1	1	1	G										X			unknown	0.5
21[1]	9[2]	2	2	UNT					X								2-5	0.9
31	4	4	15	S		X									X		spalled	4.1
43/44	5	2	18	S			X					X				X	4-7	10.5
	6	2	2	S				X							X	X	5-8	13.7
44	11[3]	3	18	S		X									X	X	5-8	14.1
	12[4]	1	1	S		X											4	0.6
46	2	1	3	G					X								4-5	1.6
	3	2	2	G			X										5-6	2.8
	7	2	3	S		X										X	5-9	11.7
54	8	1	1	S										X		X	spalled	0.5
00	10	3	3	G										X			spalled	4.4

NOTES

[1] One sherd was located outside of concentration

[2] Vessel is an untempered pine bowl

[3] Vessel has Punctate Surface Treatment/Decoration

[4] Vessel is a small bowl

Concentration 374.21 is quite isolated from the areas of greatest pottery accumulation and only contains a fragment of grit-tempered pottery, a piece of the finely decorated pipe, two Susquehanna Broadspear projectile points, and a Levanna point. A Late Archaic/Early Woodland occupation is suggested for this area with a possible Late Woodland component.

Concentrations 374.43 and .44 combined have the largest amount of pottery and all of it is shell-tempered. The variety of decorative techniques used on the vessels including cordmarking, dentate, punctate, combing and fabric impressing as well as the presence of the small bowl from this area all suggest a Middle/Late Woodland occupation. This is supported by the six Levanna points and preforms recovered there.

The incised and dentate stamped, grit-tempered lots and the cordmarked, shell-tempered lot from Concentration 374.46 along with one Levanna point suggests a Middle-Late Woodland occupation in this area.

Prehistoric Ceramics, Herring River Area

19BN471

Site 19BN471, located along the Herring River in Wellfleet, is decidedly different from the Nauset Bay sites in terms of the pottery recovered. The site has been extensively potted and may have been graded in the historic period. Sherds comprising the different vessel lots seem to be spread out in a direction roughly parallel to the Herring River.

Given the limited testing in the site area, there is quite a bit of pottery (201.2 g). Sherds were recovered in several shovel tests and all five of the excavation units (Table 14.21). Since no concentrations have been delineated for the site area yet, no comments can be made on the association of pottery with high artifact density areas. Seven vessel lots have been identified at the site including six grit-tempered and one mixed grit- and organic-tempered lot. These lots represent 91.7% of all the sherds retrieved.

19BN471, Stylistic Attributes

Three of the vessels are cordmarked (Table 14.23), two lots only on the exterior surface and one lot on both surfaces. The latter is a characteristic typical of Vinette 1 pottery. One of the former lots also has some incising bordering the cordmarked impressions, but there is not enough of the vessel to determine any decorative pattern or motif. Two other vessel lots are decorated with an undetermined technique due to weathering,

TABLE 14.21

Vessel Lot Attributes from 19BN471

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
	1	3	17	G	X												6-13	37.0
	2	8	28	G		X			X						X		5-9	52.3
	3	7	25	G							X				X		7-9	47.6
	4	3	6	G										X			7-9	9.4
	5	2	13	G		X									X		8-10	15.3
	6	1	1	G		X											6	2.1
	7	7	35	M[1]										X	X		7-9	20.8

NOTES

[1] Grit and organic material temper

while another is undecorated. A dentate stamp applied in rocker fashion is the technique used on the final grit-tempered vessel lot.

19BN471, Technology and Function

Perhaps the most interesting feature of these vessel lots is the variation in the nonplastic inclusions added to the clay. Although angular quartz and crushed granite are present in all seven vessel lots, two lots have other additions. The dentate rocker stamped lot also contains large pieces of mica, an inclusion that is not widely used on the outer Cape. In fact, its most prevalent use is in the High Head area in North Truro at 19BN481, but it was found also in isolated vessel lots at 19BN308 and 19BN341 in the Nauset Bay area. Rocker dentate stamping and incising are the decorative techniques associated with all of these granite and mica-tempered lots from the widely separated sites.

The mixed-tempered vessel lot at 19BN471 contains some grit inclusions but the large number of elongated voids suggests that another material was added in at least the same proportion as the grit. Although leached shell was first considered as the derivation of the voids, no shell-like impressions are visible. The presence of a large piece of charred wood in Vessel Lot #3 and the impressions of organics on the vessel exterior strongly suggests that grit and organic inclusions were mixed in with the clay. This is the only occurrence found thus far on the outer Cape for such a temper combination.

Four out of the seven (57%) vessel lots have evidence of fracturing along coil junctures, a much greater percentage than among the grit-tempered vessel lots from Nauset Bay. Interestingly, the lot with the greatest number of coil breaks is the mixed-tempered one suggesting that the combination of inclusions used or the forming technique was not very successful. Although no carbonized residue was found on the interiors of any of these vessel lots, four of the lots have sherds with blackened interiors. It is likely that the blackening is due to cooking; residues may have been washed or weathered off.

Only one of the vessel lots has lip/rim sherds. The undecorated lot has a lip which comes to a rounded point on a rim which is basically vertical along the exterior wall but is everted along the interior wall. This is from tapering the considerable body wall thickness to a much thinner state at the lip. This lip/rim profile is not very common on the outer Cape.

Several of the vessel lots have a noticeably hard paste which suggests that they were well- fired. Although these lots are decorated with rocker stamping and incising bordering a cordmarked exterior, the quality of firing could be related to the fortuitous position of the pots in the fire rather than

special care given to certain types of pots. The interior walls of these vessel lots as with all the others but one are smoothed and/or wiped in order to compress the large, sharp inclusions into the clay. The "mixed-tempered" lot has signs of wiping and scraping on the interior which is unusual for grit-based vessels. The care in treating the wall surfaces is somewhat reflected in the wall thicknesses. The walls are quite thin for grit-tempered pots (6-10 mm average), but the considerable amount of variation within single pots implies imperfect control over the formation process.

19BN471, Spatial Pattern and Chronological Implications

The spatial distribution of all types of remains has not yet been completed for 19BN471. No comments on the distribution of pottery remains can be made. The pottery from 19BN471 strongly suggests an Early to early Middle Woodland occupation. The cordmarked vessels are in the tradition of Vinette 1, which is associated with the Early Woodland time period. The rocker dentate stamp technique has been dated in New England to the early stages of the Middle Woodland (See Chapter 13). Due to the small total amount of pottery recovered during limited site examination investigations, the duration of the occupation at the site and a more exact date of occupation cannot yet be assessed.

The diagnostic projectile points excavated at the site also point to an Early Woodland occupation. The recovery of a Lagoon, a Rossville, and a Fox Creek point in conjunction with Vinette 1 pottery is very similar to the assemblage found in Stratum 3 at the Pratt site, Martha's Vineyard, which is dated to 520 +/- 120 B.C. (Ritchie 1969:76,220).

Prehistoric Ceramics, High Head Area

19BN415/481

The sites that were individually identified as 19BN415 and 19BN481 cover a continuous area of occupation in the vicinity of Small's Swamp at High Head in North Truro. The discussion of the pottery presented below will be incomplete since several possible features excavated at 19BN481 during the late Fall of 1982 have not been sorted and analyzed. A full integration of artifacts from both sites has not been completed, and the artifact concentrations have not been delineated.

A number of shovel tests and four excavation units at 19BN481 yielded a small amount of pottery (62.2 g), while three shovel tests at 19BN415 yielded 3.0 g of pottery. Six vessel lots are identified from the sherds recovered from 19BN481 which

TABLE 14.22

Vessel Lot Attributes from 19BN415/481

Concentration	Vessel Number	Total No. Proveniences	No. Sherds	Temper Type	Surface Treatment/Decoration										Coil breaks	Carbon residue	Wall thickness range(mm)	Weight (g)
					Undecorated	Cordmarked	Dentate	Fabric Impressed	Incised	Cordwrapped Stick	Complex Dentate	Combed	Scallop	Undetermined				
	1	6	22	G			X		X						X	X	6-9	22.2
	2	2	3	G					X		X				X		6-8	10.9
	3	1	2	G		X											spalled	1.8
	4	6	38	M		X									X		8-10	13.1
	5	1	9	S		X											spalled	2.1
	6	1	2	S		X									X		5-6	0.4

include three grit-tempered, one mixed-tempered, and two shell-tempered lots (Table 14.22). These lots represent 81.2% of all the sherds excavated; some of the grit- and mixed-tempered sherds were too spalled to assign to a lot (Table 14.1).

19BN415/481, Stylistic Attributes

There is some variation in the decorative techniques used on the grit-tempered vessel lots (Table 14.22). Although one lot has a cordmarked exterior, the other two lots exhibit two types of decorative techniques per vessel. Incising was combined with dentate and scallop shell stamping respectively. The scallop shell was applied in a rocker fashion and an incised line horizontally borders the area of rocked scallop. Incisions were applied in short strokes along the lip of the other case, although these marks may be fingernail impressions. The use of incised lines to border other decoration is present at 19BN471 in Wellfleet and occasionally in the Nauset Bay area such as at 19BN274/339.

The mixed and shell-tempered lots are all cordmarked. Unfortunately, the twist of the cord cannot be determined at this time without taking impressions of the cording.

19BN415/481, Technology and Function

All of the grit-tempered lots contain crushed granite; however, two of the lots also have large pieces of mica. This is the only site excavated by the Survey that has more than one vessel lot tempered with mica found within a relatively concentrated area. The same combination of mica and granite inclusions is found at 19BN471 in Wellfleet and at 19BN308 and 19BN341 at the Nauset Bay. Dentate stamping and incising are consistently associated with these types of inclusions at all the sites. Unfortunately, Moffet (1959) does not mention the types of stone temper included in the Vinette 1 and dentate stamped pottery he retrieved at the Small's Swamp site.

The type of shell used to temper the vessels could not be determined for this site. In one lot, however, the shell seems to be burned which has important implications discussed in the ceramic technology section (see Chapter 13).

Representative vessel lots from all three temper types have evidence of coil breaks although only one grit-tempered vessel of the group has carbonized residue (Table 14.22). These frequencies are typical of the outer Cape.

One grit-tempered vessel lot has evidence of a square lip, but the rim profile could not be discerned. In general, the wall thickness of the differently tempered lots conforms to the tendency that the grit-tempered vessels are somewhat thicker than

the shell-tempered vessels. Severe spalling in two cases limits the sample basis for this statement. The mixed-tempered lot is thicker than both the grit and shell-tempered lots but lies well within the range of variation found on outer Cape Cod.

19BN415/481, Spatial and Chronological Implications

Several possible cultural features were excavated at 19BN481 but, as yet, the features and their contents have not been fully processed. This prevents detailed assessment of the pottery spatial pattern, except to note that pottery is contained in two of the features excavated at the site.

As with Moffett's assessment of the nearby Small's Swamp site, the pottery from 19BN481 suggests at least two periods of occupation. The cord-marked, grit-tempered lot is probably Vinette 1 of the Early Woodland. The dentate, rocker-stamping and incising techniques are also attributable to Early/Middle Woodland. The presence of cordmarking on the mixed and shell-tempered vessel lots suggests a Late Woodland component.

Ceramic Assemblage Patterns, A Synthesis

The ceramic assemblages delineated into vessel lots from 14 individual site areas on outer Cape Cod, each site with numerous delineated concentrations, have been presented and discussed. Although some intersite and interregional comparisons of stylistic and technological attributes were made in the site summaries, the primary emphasis was upon intra and interconcentration comparisons. It is the purpose of this synthesis to bring the discussion to a more regional perspective. The same four foci--stylistic, technological and functional, spatial, and temporal aspects of the ceramic remains will be discussed.

The sites and their ceramic assemblages are located in two principal areas: Nauset Bay and the area north of the Herring River at the Wellfleet/Truro town line. The eleven sites around Nauset Bay are divided into five smaller areas including: Fort Hill (19BN308 and 19BN323); southern side of Salt Pond (19BN273/275, 274/339, 340, and 341); northern side of Salt Pond (19BN288 and 390); northern side of Nauset Marsh (19BN333, 336, and 337); and Coast Guard Beach (19BN374). The three sites to the north of the Herring River come from three distinct areas: Herring River (19BN471), High Head (19BN415/481), and the Provincelands (19BN410). Site 19BN410 is included in this discussion even though it was not described in the preceding section because it includes only a single vessel lot. Several other sites on the outer Cape yielded tiny bits of pottery but are not included in this discussion.

Stylistic Variation

Tables 14.23, 14.24 and 14.25 summarize the methods of surface treatment and decoration by vessel lot according to the three temper types. The site areas are grouped in the areas just described to facilitate spatial comparisons.

It is clear that there are a large variety of decorative techniques with which the prehistoric potters decorated their grit-tempered vessels (Table 14.23), more so than for shell (Table 14.24) or mixed-tempered (Table 14.25) vessels. Within one site area considerable variation in the techniques used is found, probably because the vessel lots are in different concentrations that represent different activities at different points in time. It is obvious, however, that dentate impressing, either in linear forms or rocked, was the principal form of decoration used on grit-tempered pottery in the Nauset Bay region. Cordmarking on the grit-tempered vessels which often are Vinette 1 types of the Early Woodland is almost absent in this region except for one possibility at Site 19BN288. The large number of undecorated lots may be more a function of the number of sherds available with which to identify the lots than the actual absence of decorative technique.

The two sites from the Herring River and High Head, however, not only have more identified vessel lots made with grit temper than is often the case at Nauset, but include definite Vinette 1 vessel lots. These sites also have several techniques used on single vessels, another difference from the Nauset assemblages. Dentate impressions and incising are the other prevalent techniques and have percentages in line with those among the Nauset sites.

Among the shell-tempered lots, cordmarking is the most prevalent type of surface treatment at almost every site (Table 14.24). Site 19BN274/339 is the only exception, with no cordmarked vessel lots. This supports the interpretation of Concentration 274/339.12 as a Middle Woodland component since during the Middle Woodland period cordmarking was not commonly used. Linear dentate impressions, in contrast to the use of both linear and rocker dentate on the grit-tempered vessels, and a cord wrapped stick are the most widely used decorative techniques in the Nauset area.

Each site in the Nauset area includes vessels with several forms of decoration so that it is difficult to note any site or sub-regional preferences. Scallop impressing is the only possible exception and seems to be confined to Fort Hill and the southern side of Salt Pond. This association is further emphasized when the mixed shell and grit- tempered, scallop impressed lots are included (Table 14.25). Several different techniques are found on five individual shell-tempered vessels at three different sites in the Nauset area. The multiple techniques at 19BN274/339, which are possibly related to

TABLE 14.23

Frequencies of Types of Surface Treatment and Decorative Techniques of Grit-tempered Vessel Lots by Site

Site	Number of Vessels	Cordmarked		Linear Dentate		Rocker Dentate		Fabric Impressed		Scallop Impressed		Incised		Combed		Undecorated		Undetermined		Multiple techniques	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
19BN308	6			1	17							2	33	1	17	1	17	1	17		
19BN323	3			2	67											1	33				
19BN273/275	1															1	100				
19BN274/339	0																				
19BN341	8			3	38											3	38	1	12		
19BN288	3	1	33	1	33													1	33		
19BN390	6			1	17	1	17	1	17	1	17					2	33				
19BN333	1															1	100				
19BN336	3															1	33	2	67		
19BN337	1																	1	100		
19BN374	4			1	25							1	25					2	50		
19BN471	6	2	33			1	17									1	17	1	17	1[a]	17
19BN481	3	1	33																	2[b]	67
19BN410	0																				
TOTALS	45 100%	4	9%	9	20%	3	7%	1	2%	1	2%	3	7%	1	2%	11	24%	9	20%	3	7%

[a]One vessel with cordmarking and incising:

[b]One vessel with dentate and incising; another with rocker dentate and incising

TABLE 14.24

Frequencies of Types of Surface Treatment and Decorative Techniques for Shell-tempered Vessel Lots by Site

Site	Number of Vessels	Cordmarked #	Cordmarked %	Linear Dentate #	Linear Dentate %	Cordwrapped Stick #	Cordwrapped Stick %	Scallop Impressed #	Scallop Impressed %	Fabric Impressed #	Fabric Impressed %	Punctate #	Punctate %	Multiple Techniques #	Multiple Techniques %	Undecorated #	Undecorated %	Undetermined #	Undetermined %
19BN308	21	11	52	1	5	1	5			1	5					7	33		
19BN323	6	2	40	1	20			1	20									1	20
19BN273/275	5	3	60	1		1	20	1	20										
19BN274/339	5			1	20			1	20			1	20	2[a]	40				
19BN341	16	10	62	2	13	3	19									1	6		
19BN288	8	3	38	1	12	1	12			1	12			1[b]	12			1	12
19BN390	3	2	67													1	33		
19BN333	1																	1	100
19BN336	4	2	50			1	25									1	25		
19BN337	0																		
19BN374	7	3	13							1	14			2[c]	29			1	100
19BN471	0																		
19BN481	2	2	100																
19BN410	1	1	100																
TOTALS	78	39	50	6	8	7	9	3	4	3	4	1	1	5	6	10	13	4	5

a. One vessel with cordwrap stick, incising and punctate; another with linear dentate and incising.
b. A vessel with cordmarking and incising.
c. One vessel with linear dentate and combing; another with cordmarking and punctate.

TABLE 14.25

Frequencies of Types of Surface Treatment and Decorative Techniques for Mixed Tempered Vessel Lots by Site

Site	Number of Vessels	Cordmarked		Cordwrapped Stick		Scallop Impressed		Fabric Impressed		Incised		Undecorated		Undetermined	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
19BN308	5	1	20			1	20			1	20	1	20	1	20
19BN313	0														
19BN273/275	1											1	100		
19BN274/339	1											1	100		
19BN341	4					1	25	1	25			1	25	1	25
19BN288	3	1	33									1	33	1	33
19BN390	2			1	50							1	50		
19BN333	0														
19BN336	0														
19BN337	1	1	100												
19BN374	0														
19BN471	1[a]													1	100
19BN481	1	1	100												
19BN410	0														
TOTAL	19	4	21	1	5	2	10	1	5	1	5	6	32	4	21

[a]Tempered with grit and organics

stylistic preferences during the Middle Woodland period, differ from 19BN288 and 19BN374. Shell-tempered vessels usually have some kind of surface treatment or decoration and it is unusual that 33% of the vessel lots at 19BN308 are undecorated, but again this may be the result of a small number of sherds designating a vessel lot.

The two sites with shell-tempered lots in the northern regions of the outer Cape include only cordmarked decoration; however, small sample size might be causing this association.

Mixed temper vessel lots are identified at many of the sites in the Nauset Bay area (Table 14.25). The percentages of the surface treatment and decorative techniques used on these vessels are roughly similar to those of the shell-tempered vessel lots. Cordmarking is fairly common and scallop impressing occurs in the same site areas as the shell-tempered lots. The large number of undecorated lots again probably relates to an insufficient number of sherds on which to base a true assessment of the decorative techniques.

Site 19BN415/481 at High Head has the only mixed-temper vessel lot of the northern sites. The other mixed-temper lot at 19BN471 on the Herring River contains grit and organic temper; unfortunately, its decorative technique cannot be determined.

Table 14.26 summarizes the scanty information on the types of decorative motifs found on the prehistoric pottery of the outer Cape in relation to temper types. It should be apparent that the very simple design of horizontal or vertical parallel rows is the most prevalent motif for all three temper types. This suggests either great temporal continuity of stylistic tastes or relates to vessel function and the low priority given to elaborate decoration on the surfaces of vessels produced expediently for a single routine domestic activity. The other motif with continuity is the cross-hatch which occurs with very similar frequency among the grit- and shell-tempered vessels.

The shell- and mixed-tempered lots have a fairly high frequency of triangular-based motifs, such as chevrons and triangles, in comparison to the grit-tempered lots. Three of five lots come from concentration 274/339.12, a seemingly Middle Woodland component, and may represent a stylistic preference at this time period. It is also possible that there was some functional variation in the pottery during the Middle Woodland that resulted in the desire for more elaborate decorative motifs.

Given the small sample size it is very difficult to make any strong statements concerning regional variation in decorative motifs. There seems to be a fair amount of variety within each area around Nauset Bay. Perhaps this observation is significant in iself; it is possble that there was considerable stylistic freedom among the potters producing for their own use on outer Cape Cod.

TABLE 14.26

Frequencies of Vessels for each Decorative Motif Type by Temper Category

Site	Grit Temper							Shell Temper						Mixed Temper						Grand Totals
	1	2	3	4	5	6	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	
19BN308	1			1	2		4	1				1	2	2					2	8
19BN323	1						1	1		1			2						0	3
19BN273/275							0			1	1		2						0	2
19BN274/339							0	1	1	3			5						0	5
19BN341	3				1		4	3					3						0	1
19BN288		1					1	2				2	4						0	5
19BN390	2					1	3						0			1			1	4
19BN333							0						0						0	0
19BN336							0						0						0	0
19BN337							0						0						0	0
19BN374	1	1					2	2				1	3						0	5
19BN471						1	1						0						0	1
19BN415/481	1					1	2						0						0	2
19BN410							0						0						0	0
Total	9	2		1	3	3	18	10	1	5	1	4	21	2		1			3	42
Percentage	50	11		6	17	17	100	48	5	24	5	19	100	67		33			100	

KEY
1 = horizontal or vertical parallel rows, 2 = diagonal parallel lines, 3 = triangular, 4 = wavy lines, 5 = cross hatch, 6 = rocker

Technological/Functional Variation

It was argued in Chapter 13 and in earlier analyses (Childs 1982) that the prehistoric peoples of outer Cape Cod manufactured pottery vessels in an expedient manner for the primary purpose of cooking. This model of expediency involves the rapid construction of vessels at intermittent intervals arising when need dictates. Such need might occur when a pot broke during cooking from situations of carelessness or overuse or from extended thermal stress that weakened the body.

The vessel lot data support this model as a widespread phenomenon over the Outer Cape and extending over time. Examination of Table 14.27, which summarizes the frequencies of vessels with coil breaks, on one hand, and with carbonized residues on the other hand, shows considerable consistency among the three temper types. The very high percentage of shell-tempered vessels with coil breaks (58%) suggests that either there was a slight change in the manufacturing technique that did not promote the close bonding of the coils, or that the temper and clay resources had properties that discouraged optimal coil bonding.

The potential reactions of disintegration set up from firing shell at temperatures above 650 degress Centigrade or so have been discussed. When large shell fragments are added to clay and are then rolled into relatvely thin coils, the shell will become aligned within the coil, but extra care is required to interconnect the shell fragments of the adjoining coils for a tight bond. The final building stage using the paddle and anvil which should help to thin the walls and further bond the coils could have minimal effect if little pressure was applied, it was done quickly, or poor coil bonding already existed.

The possibility that differential care was taken in the construction of vessels with different types of surface treatment/decoration was examined for each temper type (Table 14.28). Two things are immediately apparent. First, cord-marked, shell-tempered vessels have a very high rate of breakage along the coils at all the sites. Second, dentate stamped, grit-tempered vessels also have a high frequency of coil breaks. For all three temper types, the "other" category of decorative techniques which tend to be the more unusual or elaborate ones also show a definite lack of coil breaks. There might be a pattern of extra care in manufacturing for vessels that were to be decorated in different ways. Further analysis is necessary to test this notion.

If the pottery vessels primarily functioned in the cooking sphere, it is expected that they would show evidence of this type of use, such as carbonized residues. The total vessels of the three temper types show remarkable consistency in the presence of residues from the outer Cape Cod sites (Table 14.27). The frequencies of between 24-32%, however, are lower than might be

TABLE 14.27

Frequencies of Coil Breaks (CB) and Carbon Residue (CR) Associated with Vessels by Temper Category

		Coil Breaks Associated with Vessels									Carbon Residue Associated with Vessels									Coil Breaks and Residue Associated with Vessels		
		Grit			Shell			Mixed			Grit			Shell			Mixed					
Site	Total Vessels	with CB	w/o CB	Total	with CB	w/o CB	Total	with CB	w/o CB	Total	w/R	w/oR	Total	w/R	w/oR	Total	w/R	w/oR	Total	Grit vessels	Shell vessels	Mixed vessels
19BN308	32	2	4	6	12	9	21	1	4	5		6	6	5	16	21		5	5		4	
19BN323	8	1	2	3	1	4	5			0	1	2	3	1	4	5			0			
19BN273/275	7	4	1	1	3	2	5	1	0	1		1	1		5	5	1	0	1			1
19BN274/339	6			0	2	3	5	1	0	1			0		5	5		1	1			
19BN341	28	4	4	8	11	5	16	1	3	4	8	0	8	7	9	16	4	0	4	4	4	1
19BN288	14	2	1	3	6	2	8	2	1	3		3	3		8	8	1	2	3			
19BN390	11	1	5	6	1	2	3	1	1	2	2	4	6		3	3		2	2	1		
19BN333	2		1	1	1	0	1			0		1	1		1	1			0			
19BN336	7	1	2	3	3	1	4			0		3	3		4	4			0			
19BN337	2		1	1			0		1	1		1	1			0		1	1			
19BN374	11		4	4	3	4	7			0		4	4	5	2	7			0		2	
19BN471	7	3	3	6			0	1	0	1		6	6			0		1	1			
19BN481	6	2	1	3	1	1	2	1	0	1		3	3		2	2		1	1	1		
19BN410	1			0	1	0	1			0			0		1	1			0			
Total	142	16	29	45	45	33	78	9	10	19	11	34	45	18	60	78	6	13	19	6/45	10/78	2/19
Percentage		36	63	100	58	42	100	47	53	100	24	76	100	23	77	100	32	68	100	13	13	11

TABLE 14.28

Associations between Surface Treatment or Decoration and Coil Breaks by Temper Type

Vessels with Coil Breaks

Site	Grit					Shell					Mixed					Total Vessels
	1	2	3	4	Total	1	2	3	5	Total	1	2	3	6	Total	
19BN308	1			1		3	8		1					1		15
19BN323			1				1									2
19BN273/275							2		1		1					4
19BN274/339									2		1					3
19BN341	1		3			1	10							1		16
19BN288		1		1			3		3		1	1				10
19BN390			1			1					1					3
19BN333									1							1
19BN336				1		1	2									4
19BN337																0
19BN333/336/337				1		1	2		1							5
19BN374							2		1							3
19BN471		2	1											1		4
19BN481			2				1					1				4
19BN410							1									1
Total	2	3	8	4	17	7	32		10	49	4	2		3	9	75
Percentage	12	13	50	25	100	14	65		20	99	44	22		33	99	

KEY
1 = undecorated; 2 = cord marked; 3 = dentate; 4 = incised, undetermined (2); 5 = fabric impressed (2), scallop impressed (2), dentate, cordwrap stick, undetermined (2); 6 = fabric impressed, scallop impressed, undetermined.

expected but there are at least three possible explanations, including: (1) post-depositional weathering of the sherds, (2) the types and numbers of sherds excavated and used to identify a vessel lot since residues are expected most on the relatively rare rim and neck sherds, and (3) the pots were cleaned after use. It is impossible to know to what degree these factors influence the frequencies for each temper type or whether different factors affect dfferently tempered vessels. Although not tabulated, many of the vessels without residues had the same blackening of the interior wall that is associated with the carbon residues.

Carbon residues found on vessel walls are not present at all of the sites in the Nauset Bay region and on none of the vessels from the northern sites. Sites 19BN308, 341 and 374 have much higher percentages of vessels with residues than others, although this may relate more to post-depositional activities, vessel lot sherd sizes, and, possibly, differences in the discard and abandonment patterns at the sites than to function.

Since the thermal stress set up during cooking might be one of the causes for the high frequency of vessels with coil breaks, the frequency of interaction between the vessels with both coil breaks and residue was examined (Table 14.27). Although there are not many cases of this correlation over the sites in the study group, there again is remarkable consistency in the percentages among the three temper types. This might suggest that similar factors, such as those presented above, have affected the sherds of different temper types in similar ways.

Another technological attribute of interest on a regional basis is vessel wall thickness. This attribute is important because it has been considered in the creation of the traditional regional pottery chronologies (Fowler 1966; Moffet 1957). A general trend toward thinner walls over time has been suggested, especially in the change from grit-tempered vessels to those tempered with shell. Within the shell category, a definite thinning of the walls during the later Late Woodland period has been observed.

Figure 14.1 provides a very general view of wall thickness variation from all the sites considered in this analysis and tends to support the traditional observations. There is a slightly bimodal distribution of the grit-tempered vessel wall thicknesses; the thickest group of vessels are primarily Vinette 1 or have rocker dentate stamping. The primary, much larger mode is clearly considerably thinner. It also overlaps with a large proportion of the shell-tempered vessels. The shell-tempered vessels also have a similar, slightly bimodal distribution with the thicker group usually associated with cordmarking. It is this latter group which should provide some evidence of a thinning trend, but does not. Overall, the evidence supports the pattern of wall thickness reduction over time, but it warrants closer examination.

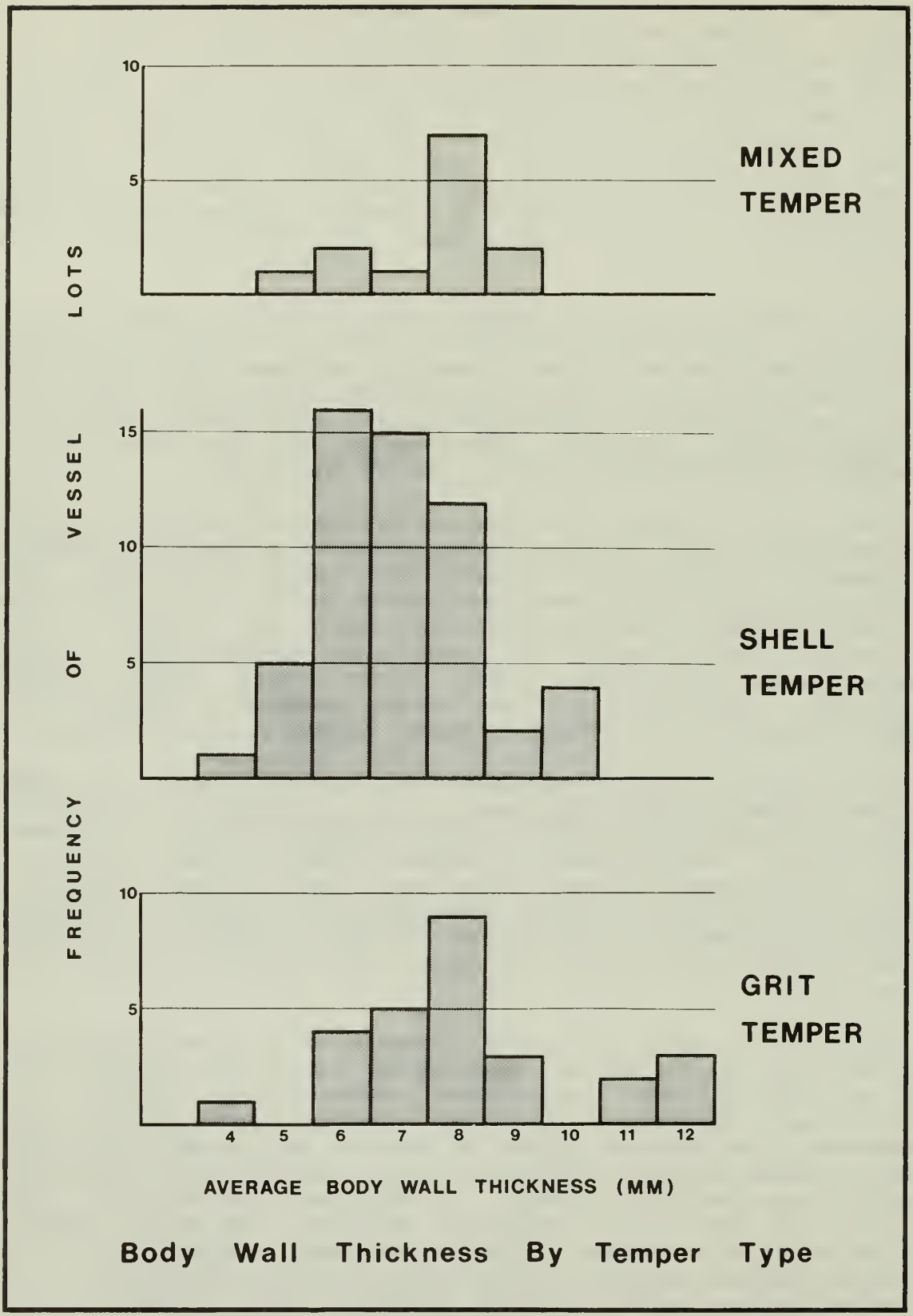
FREQUENCY OF VESSEL LOTS
10
5
MIXED TEMPER
15
10
5
SHELL TEMPER
10
5
GRIT TEMPER
4 5 6 7 8 9 10 11 12
AVERAGE BODY WALL THICKNESS (MM)
Body Wall Thickness By Temper Type

FIGURE 14.1

A final technological note concerns the types of materials used for temper on a regional level. The shell-tempered vessels constructed in the Nauset Bay area show considerable consistency in the use of scallop shell, suggesting a long-standing tradition. The advantages of this shell type have been discussed, but it must be emphasized that the ease of identifying scallop versus the smooth-walled quahog and soft shell clam may have influenced this observation. It also is possible that much of the shell temper was burned prior to use but the extent and consistency with which this was done is not known.

The grit-tempered vessels from the Nauset assemblages usually were tempered with crushed granite and angular quartz, either combined or separately. There may have been some different preferences by site area, but the immediate availability of broken-up stone was probably the principal factor in determining the type used. Of importance, however, is the more common use of large pieces of mica at the northern sites, 19BN415/481, in particular, and 19BN471. This material type is exceedingly rare among the Nauset Bay assemblages and its infrequent presence in Nauset concentrations may indicate exchange between the peoples occupying the Nauset Bay area and others around High Head, or the special procurement of mica for temper from High Head sources by potters residing at Nauset. These possibilities need to be tested with the distribution of other artifact types and materials, and closer analysis of the ceramics.

Spatial Patterns

As a rule on the outer Cape Cod sites, pottery has low visibility which suggests that the frequency of manufacture was not high. The presence of pottery, however, is much stronger and quite predictable, it turns out, in relation to two types of prehistoric cultural phenomena: the hearth, as suggested by the dense fire-cracked rock deposits, and the midden. These associations have been explicitly described in the site summaries for each concentration where they occur.

From the wider perspective of the Nauset Bay area, or even the whole outer Cape, it can be emphasized that every concentration with evidence of a hearth has considerable amounts of pottery in the immediate vicinity. Likewise every midden excavated with clear temporal associations to the Woodland period contains some bits of pottery. These pieces are often very small, such as what would be expected from the trampled debris swept off a house floor. It is interesting that the sherd sizes from the hearth-like areas at sites like 19BN274/339 or 19BN390 are much larger. Sherds from pots broken during cooking in a hearth would be less likely to be trampled and eroded than those from pots broken elsewhere and not immediately swept up and removed to secondary trash deposits.

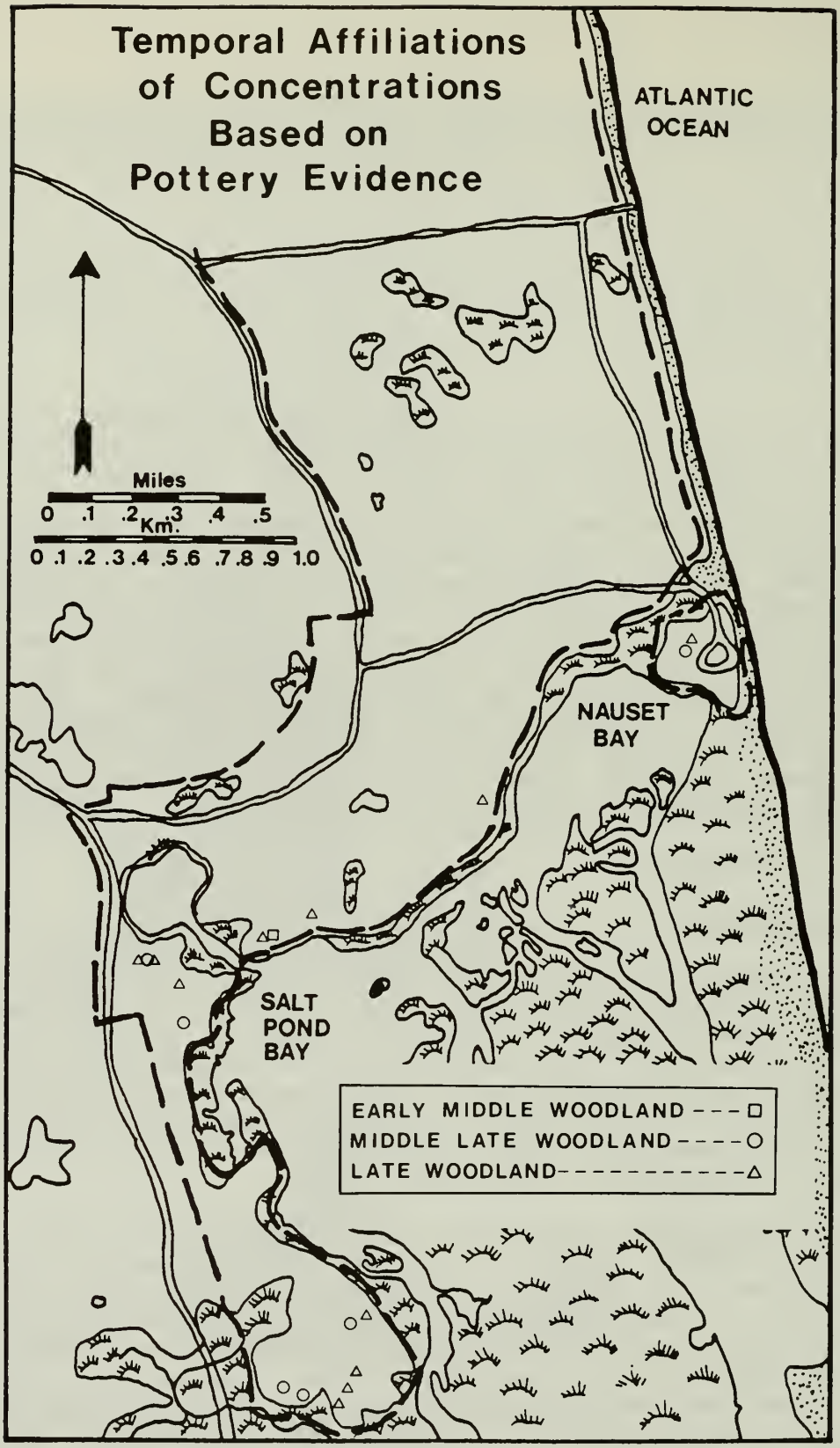
Temporal Affiliations
of Concentrations
Based on
Pottery Evidence
ATLANTIC
OCEAN
Miles
0 .1 .2 .3 .4 .5
Km.
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
NAUSET
BAY
SALT
POND
BAY
EARLY MIDDLE WOODLAND
MIDDLE LATE WOODLAND
LATE WOODLAND

FIGURE 14.2

The combination of the strong presence of pottery around hearths and in refuse areas and the pottery density study which showed a strong association of pottery with areas of high artifact density both suggest a strong affiliation of pottery with domestic activity areas. Concentrated occurrences of pottery in non-midden contexts might aid in delineating the spatial patterning of activity areas over a site. Furthermore, the lack of pottery in concentrations that are generally dateable by other means suggests specialized activity areas where cooking did not occur and pottery vessels were not used. An example of this possibility is 19BN340, situated along the banks of Nauset Bay, where one sherd was recovered. The topographical location of this site suggests that it may have functioned primarily for fishing-related activities which did not require pottery. This possibility must be tested further and should be considered for other sites on outer Cape Cod.

Temporal Variation

The primary pottery attributes used for New England pottery chronologies have been decorative technique and temper, although decorative motif and wall thickness have been used as supplementary data. The variation in decorative techniques and motifs from the outer Cape Cod sites are discussed above so this brief section will focus upon the tentative temporal placement of the sites based on that information.

On a very gross scale, the sites toward the northern end of the outer Cape, 19BN471 and 19BN415/481, have a more definite association with the Early and Middle Woodland periods than any of the Nauset Bay sites. Two possible exceptions around Nauset Bay are Concentrations 274/339.12 and 390.33.

Examination of the Nauset Bay region on a finer scale (Fig. 14.2)shows a predominance of Late Woodland occupations based on the tentative temporal assessment of the pottery. The areas to the north and south of Salt Pond seem to be the most heavily used over the millennia with suggestions of occupation from the Early through the Late Woodland. The excellent access to resources and the topographical advantages may have been two considerations repeatedly used over the centuries in making decisions to occupy this area. The Fort Hill area, too, was occupied at least during the Middle through Late Woodland period.

Conclusion

It should be clear from this synthesis and the report in general that the examination of prehistoric New England pottery has widespread potentials for many aspects of the archeological interpretation of prehistoric culture. Not only can a

typological and cultural chronology in the traditional sense be delineated after very careful consideration of a number of pottery attributes, but insights into prehistoric economics, technology, food preparation, and both intra and intersite settlement patterns can be provided. The potentials are there, we only have to try.

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CHAPTER 15

Stones for Tool-Making: Local Resources and Archeological Observations

Christopher L. Borstel

Stone tools and debitage are common artifacts on prehistoric sites at Cape Cod National Seashore. Local exposures of glacial drift and drift-derived coastal deposits probably served as major sources of raw materials for prehistoric stone workers. At times prehistoric stone workers on the Cape may also have imported some lithic materials from distant sources. The lithology, shapes, and sizes of the stones all contribute to the structures of prehistoric technological subsystems. The norms of some past cultures emphasized the use of distinctive material types; such preferences, once identified, can serve as taxonomic markers in chronological frameworks. Evidence of long-distance transport of materials can aid investigations of prehistoric contact, communication, and interaction.

Investigation of such topics as these requires some familiarity with the characteristics of locally available rocks. This chapter examines the glacial and modern coastal sediments as potential sources of raw materials for chipped stone tool making. Relevant aspects of these deposits for stone tool makers include the types of rocks in the deposits, the size, shape, and abundance of stones in the sediments, and the geomorphic forces shaping the sediments today. With such a background, other topics, such as the constraints imposed on prehistoric lithic technolgies by local materials, the importation of materials from a distance, and the potential chronological implications of high frequencies of specific types of materials can be discussed.

The first part of the chapter focuses on the characteristics of stones. "Stones" are large pebbles, cobbles and boulders. They have a maximum length (long axis

dimension) of at least 5 cm. Pebbles smaller than 5 cm in length are difficult to shape into tools without bipolar techniques, and prehistoric people on the Cape do not seem to have bothered much with these smaller pebbles. Boulders in the drift have two origins. Small boulders were transported and deposited as part of the bed load in meltwater streams. Medium to large boulders were deposited by ice, either as ice-rafted stones or when they were freed from melting blocks of isolated, stagnant ice. Although medium and large boulders are rare, some were potential sources of raw material and are included here as "stones."

Cape Cod presents some interesting challenges for the study of prehistoric peoples' use of lithic materials. No bedrock crops out on the Cape, and the land is formed from glacial drift. Stones are scattered widely through the drift. Source exposures could have been widespread, and procurement localities need not have been functionally specialized sites. The stones in the drift represent much of the diversity of New England's lithologic provinces. Glaciers scoured drift sediments from unlithified strata and bedrock to the north, mostly from the Gulf of Maine region. Some of the source deposits are ancient coastal plain sediments, themselves built of material eroded from bedrock to the west. These geological characteristics of Cape Cod make exotic materials difficult to distinguish from locally-procured rocks and may prevent archeologists from pinpointing specific prehistoric lithic collection stations.

Stones are abundant enough on the outer Cape that Native Americans could have found many suitable sources of materials close at hand, in the archeolocical study area and immediately adjacent lands. They would have had many potential sources of material nearby their campsites and villages, this chapter emphasizes the geology of the outer Cape, especially the are encompassed by the Orleans, Wellfleet, and North Truro 7.5 minute U.S. Geological Survey quadrangles.

Today glacial drift is exposed in many places on the outer Cape. Away from the ocean, these exposures are largely the result of recent construction or quarrying, or of erosion caused by poor land management. In the prehistoric period, except for the immediate areas of camps and villages and in gardens, exposures of drift were the product of natural erosion. Thus, it is appropriate to describe the shape, size and abundance of stones as they occur in natural exposures and in sediments derived from glacial drift.

The focus of the descriptions can be further limited to the characteristics of stones along the marine shorelines.

Only along some beaches do large exposures of drift and large deposits of stones occur. Neither the shorelines of freshwater ponds nor the beds and banks of streams would have been regularly used or heavily collected sources of stones. The ponds have stable wooded banks and narrow sandy beaches on which stones are rare. The few freshwater streams are short and small with little cutting power; stones in their beds are uncommon.

This chapter is the second study of archeological lithic materials on outer Cape Cod. Moffett (1944) described the petrology of the principle varieties of rocks used by prehistoric groups in the area. Unfortunately, his paper provides no quantitative data on the lithologies of either archeological specimens or of naturally occuring rocks. His observations are useful and perceptive, and some of the issues he briefly mentions are dealt with in more detail here.

Geological Setting

Cape Cod is a complex of late Wisconsin glacial landforms that Holocene sea level rise and marine erosion have modified. Quaternary deposits rest on unconsolidated late Cretaceous to Eocene coastal plain sediments, which form a broad topographic high on the seabed (Zeigler, Tuttle, Tasha and Geise 1964:706-708, 1965:R302). Precambrian and Paleozoic crystalline basement rocks underlie the Cape at depths of 50 m to 275 m below sea level (Oldale 1969: Figure 1). This bedrock and the ancient coastal plain deposits are the primary sources for the drift sediments (Oldale 1976:16).

The drift was laid down as ice retreated northward at the end of the last glaciation. Deglaciation in the Cape Cod area appears to have been a rapid event, thought to have taken place around 16000 B.P. Geologists have identified six major drift units on the outer Cape between Chatham and Truro. From south to north these are: the Harwich outwash plain, the Nauset Heights deposits, the Eastham and Wellfleet outwash plains, the Highland deposits, and the Truro outwash plain (Oldale 1979: Figure 3). Meltwaters from the Cape Cod Bay glacial lobe (Oldale 1982: Figure 1 and 3) deposited the broad Harwich plain into a proglacial lake in the present basin of Nantucket Sound. At about the same time, the South Channel lobe to the east laid down the ice-contact Nauset Heights deposits in an ice-free area between glacial lobes. As the Cape Cod Bay lobe retreated northwards, a proglacial lake was dammed between the ice on the north and east and the drift of the middle and western Cape. Meltwaters carried sediments from the South Channel

lobe into this lake to form, succesively, the Wellfleet plain, the Truro plain and the Eastham plain. The silty Highland deposits represent a small proglacial lake unrelated to the lake in the basin of Cape Cod Bay (Oldale 1968, 1976, 1979, 1982: 25-28 Koteff et al., 1967; Oldale and Koteff 1970; Oldale et al. 1971).

The glacial deposits of the Outer Cape initially extended 4.5 km to 6 km further east than they do today (Davis 1896; Strahler 1966: Figure 15). Beginning early in the Holocene, post-glacial sea-level rise flooded the inner continental shelf (Oldale and O'Hara 1980). Once the ocean could attack the glacial deposits, marine erosion began to shape the outer Cape into its present arcuate form and created headlands, beaches, bars, and spits (Zeigler et al. 1965; Strahler 1966:27-56; Fisher 1979; Aubrey et al. 1982).

Today the eastern coast is eroding at an average rate of about 0.75 m/yr (Leatherman et al. 1981:1-10), and erosion on the Cape Cod Bay shore averages about 0.3 m/yr (Geise 1964, as cited in O'Donnell and Leatherman 1980:8). These average rates have probably been relatively constant for the past two to four millennia (O'Donnell and Leatherman 1980:8 and Table 2). Chapter 4 of this report, Oldale (1982), and O'Donnell and Leatherman (1980) contain further details about the evolution of Cape Cod.

Stones: Characteristics of the Resource

In the past eight millenia the ocean gradually has cut away the glacial deposits of Cape Cod. Sediments that provided prehistoric Cape Codders with raw materials for stoneworking have been washed into the sea. Since the sediments are gone, we cannot know the exact lithologic and textural characeristics of the stones available to prehistoric stoneworkers. However, the presently remaining sediments probably provide a good approximation of the material that was available to prehistoric people. At the same time, the geomorphic forces shaping the Cape today are the same ones that have acted over the past several thousand years. An understanding of the processes that expose and transport stones today provides and understanding of the processes that made stones available to prehistoric people.

Abundance

Data Sources

Data on the abundance of stones in the glacial drift and beaches of the outer Cape is meager. This is probably because the area is overwhelmingly composed of sand, and gravel deposits are not economically important in the area. Section and unit descriptions in geological reports for the area provide some unquantified and generalized observations. I have also made field observations of the abundances of stones in different portions of the outer Cape. I attempted to measure the abundance of stones at a few beaches using timed collections. In this technique the observer collects clasts of a certain size range for a specified interval of time. I found that 10 minute collections of stones 5 cm long and larger worked well. Since the collector estimated the size by eye, some clasts were smaller than 5 cm. None were less than 4 cm long, and because of the small number of stones measured, I have included these smaller clasts in the figures for stone shape (see Figures 15.10-15.11). At some localities I also estimated the area over which I collected to provide a second measure of abundance. Timed collections provide only crude measures of abundance, but they provide a way of illustrating differences among localities.

Variation in Drift

The glacial deposits of the Outer Cape are inhomogeneous horizontally and vertically, but stones are widely available. The drift is primarily statified glacial outwash and has abundant cut and fill sequences. Most of the drift units have deposits ranging from clayey silt to gravelly sand; occasional erratic boulders also occur. Lag deposits of stones are near the surface in some places.

Some drift units tend to be more stony than others. Based on unquantified field observations and on the glacial history of the Outer Cape (see Chapter 4), the drift units rank as follows in regard to the average abundance of pebbles and cobbles. The Nauset Heights deposits have the greatest abundance of stones. This drift unit includes layers of till and ice contact stratified deposits; it was deposited in an interlobate area between the South Channel and Cape Cod Bay lobes. The Eastham plain deposits rank next in abundance of stones. The portion remaining today was close to the source ice when it was deposited. In addition, there are numerous large erratic boulders in the eastern part of the town of Eastham (including the famous Doane Rock). Exposures of the Eastham plain frm Coast Guard Beach to Nauset Light have numerous rocks. (Stones are considerably less abundant in the western part of the

Eastham drift unit than in the eastern portion). The Wellfleet plain deposits follow behind the Eastham plain because pre-erosion reconstructions show that the remaining portion of this unit is rather far from the position of the source of the meltwater that built it. The Truro plain ranks as having the lowest abundance of stones of all of these drift units, based on unquantified comparisons in the field. The Harwich plain deposits probably span a range from high abundance in the north (close to the source of the meltwater) to lower abundance in the southern part of the unit.

Shorelines

The quantity of stones along the marine shorelines are the product of two major factors: the abundance of stones in the glacial drift supplying the shoreline sediments, and the degree to which the shore is exposed to powerful waves and currents. Of the two, exposure is the more important factor. This is because, in general, stones comprise only a small fraction of the entire volume of the outer Cape's drift sediments. Since the overall abundance of stones in most of the drift units is quite low, abundance is highest where waves and currents have the greatest capacity to winnow away finer sediments. The shoreline of Nauset Marsh and the nearby beaches on the Atlantic Ocean and Cape Cod Bay illustrate the effects of these two factors.

Nauset is protected by the barrier beach that extends south from Coast Guard Beach and north from Nauset Heights. Most of this protected embayment is filled with islands of salt marsh. Wind fetches are longest during the highest tides, when the marshes are completely flooded. Even during these highest tides fetches are quite short (Table 15.1), and waves in the embayment are small.

Most of the Nauset shoreline is like the Fort Hill area (Table 15.1 and Figure 15.1). Salt marsh fringes the shoreline; there is no beach. The hillslope down to the marsh is kept stable by a full vegetation cover. Diligent searching yields only occasional stones, and these are often half buried in the mud.

A few sections of the Nauset Marsh shoreline resemble the northern shore of Salt Pond (Table 15.1 and Figure 15.2). It faces a body of open water, and no protective marsh grows along it. The shore is a narrow beach of gravelly sand. The banks above the beach are kept stable by their full vegetation cover, but waves occasionally cause small slumps. Stones are present on the beach, but they are widely scattered.

The high numbers of stones along the Nauset Heights

TABLE 15.1

Abundance of Stones, Selected Localities, Eastham

Locality	Exposure	Maximum Fetch[a]	Approximate Beach Width	Stone Abundance
Ft. Hill SE Shoreline	protected	lw:0km hhw:2.6-3km (NE-SE) lw-hhw:1.7km (SW)	5-200m of salt marsh.	Very Low
Salt Pond N shoreline	protected	lw:1.2km hhw:2.9km (SE)	15m	Low
Nauset Heights NE shoreline	varies: presently protected	lw:<.5km hhw:4.7km (NNW)	25m	Very High
Coast Guard Beach	exposed	unlimited (NE-SE-SW)	60m	Varies: Low-High
Cook's Brook Beach	moderately exposed	lw:0km hw:28-110km (WSW-NW)	25m+tidal flat (~500m)	Moderate

[a]KEY: lw-low water, hw-high water, hhw-highest high water.

FIGURE 15.1

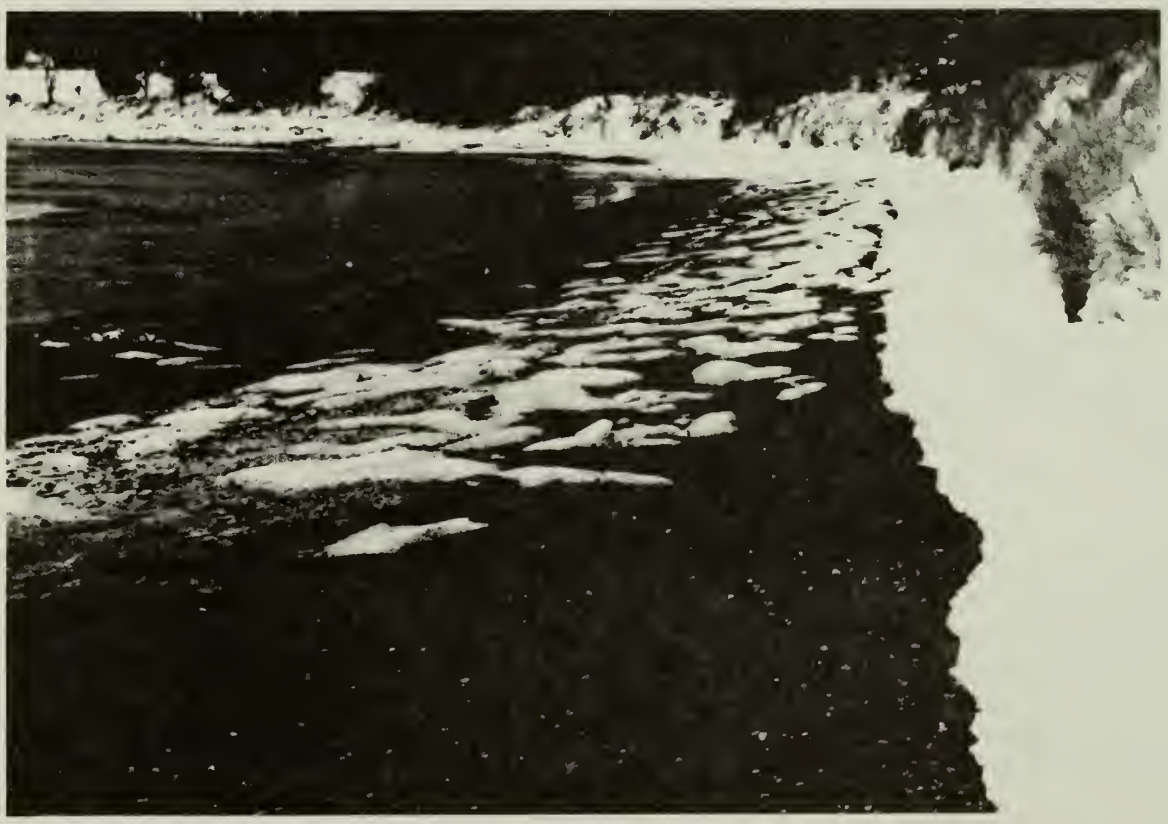


FIGURE 15.2

shoreline (Table 15.1 and Figure 15.3) is unusual compared to the rest of Nauset Marsh. Indeed, at present Nauset Heights has more stones along its shoreline than nearly any other place on the outer Cape. One reason for this is the greater abundance of stones in the Nauset Heights drift, compared to other glacial deposits on the outer Cape. The abundance of stones at Nauset Heights may also be a vestige of the recent geomorphic history of the area. At times during the historic period the channel connecting Nauset Marsh to the Atlantic Ocean has been much closer to Nauset Heights than it is today (Wright and Brennikmeyer 1979: Figure 1; Speer et al. 1982). When the channel is closer, Nauset Heights is less protected and more subject to the strong tidal current that sweeps through the channel. Both of these conditions tend to produce a stony beach.

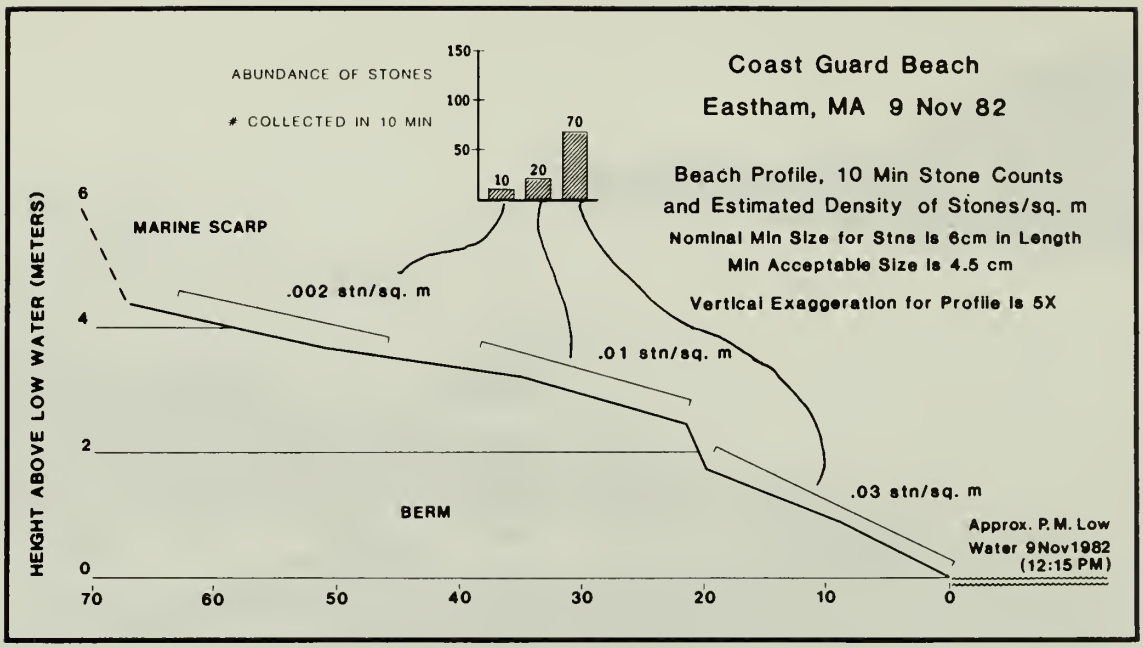
Coast Guard Beach (Table 15.1 and Figures 15.4-15.5) has many features that are common along the outer Cape's ocean shoreline. Although complex and shifting bars lie offshore, the beach is still exposed to powerful ocean waves. The beach is wide, typically 40-60m, and sandy. At Coast Guard Beach the marine scarp is low, averaging around 8 m ASL. Half a kilometer north of the beginning of the scarp, it rises to elevations of around 15 m ASL. The cliffs behind the beach are mostly bare or thinly covered by beach plants. Erosion of the cliffs is rapid, averaging 0.75 m/year for the period between 1956 and 1979. This rate represents only an average figure for the entire length of cliffs between Coast Guard Beach in Eastham and Highland in North Truro. Erosion takes place in episodes; a section of cliff can be stable for several years and then quickly retreat several meters, sometimes in a single slump (Leatherman et al. 1981; Gatto 1979; Zeigler et al. 1964). At an average retreat rate of 0.75m/yr and an average cliff elevation of 8.2m, erosion removes 1500 m^3/yr of sediment from the first half kilometer of cliffs at Coast Guard. This figure, following Ziegler et al. (1964), represents the sediment eroded from above 4.3m ASL, roughly the upper limit of the intertidal zone. Waves and currents remove an additional volume of glacial drift in the intertidal and subtidal zones. At a rate of coastal retreat of 0.75m/yr, an average of 10,500 m^3/km/yr of glacial sediment are eroded from +4.3m ASL to a depth of -12.2m (recomputed from Zeigler, Tuttle, Geise and Tasha's [1964: Table 1] using Leatherman et al.'s [1981] cliff retreat rate). Thus, roughly 6800/m^3 of sediment per year are currently being eroded at Coast Guard Beach. A small percentage of this volume consists of stones that are sometimes exposed on the beach.

Pebbles, cobbles, and boulders vary in abundance across the beach profile. The quantity of stones on the beach also changes as the profile varies over time. The beach profile changes with changing sea and tide conditions (Zeigler et

FIGURE 15.3

FIGURE 15.4

FIGURE 15.5


Coast Guard Beach
Eastham, MA 9 Nov 82
Beach Profile, 10 Min Stone Counts
and Estimated Density of Stones/sq. m
Nominal Min Size for Stns is 6cm in Length
Min Acceptable Size is 4.5 cm
Vertical Exaggeration for Profile is 5X
ABUNDANCE OF STONES
COLLECTED IN 10 MIN
150
100
50
10
20
70
HEIGHT ABOVE LOW WATER (METERS)
6
4
2
0
MARINE SCARP
.002 stn/sq. m
.01 stn/sq. m
.03 stn/sq. m
BERM
Approx. P.M. Low
Water 9Nov1982
(12:15 PM)
70
60
50
40
30
20
10
0

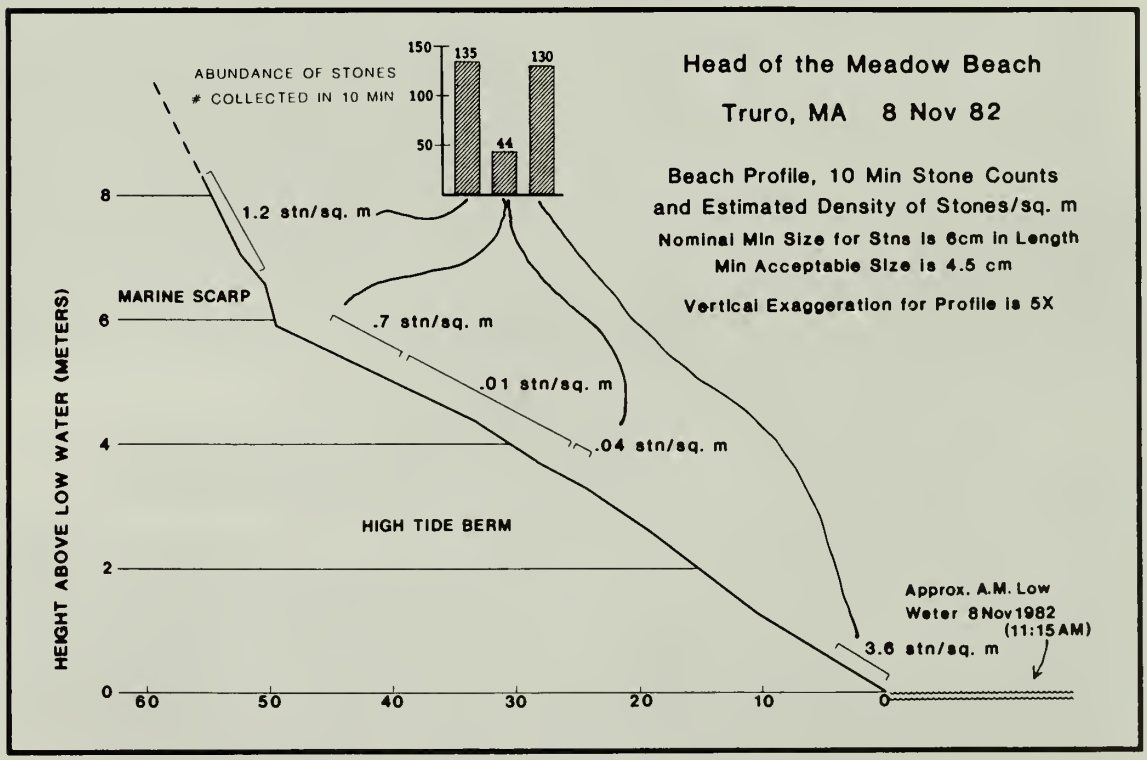

Head of the Meadow Beach
Truro, MA 8 Nov 82
Beach Profile, 10 Min Stone Counts
and Estimated Density of Stones/sq. m
Nominal Min Size for Stns is 6cm in Length
Min Acceptable Size is 4.5 cm
Vertical Exaggeration for Profile is 5X
ABUNDANCE OF STONES
COLLECTED IN 10 MIN
150
100
50
135
44
130
HEIGHT ABOVE LOW WATER (METERS)
8
6
4
2
0
1.2 stn/sq. m
MARINE SCARP
.7 stn/sq. m
.01 stn/sq. m
.04 stn/sq. m
HIGH TIDE BERM
Approx. A.M. Low
Water 8Nov1982
(11:15AM)
3.6 stn/sq. m
60
50
40
30
20
10
0

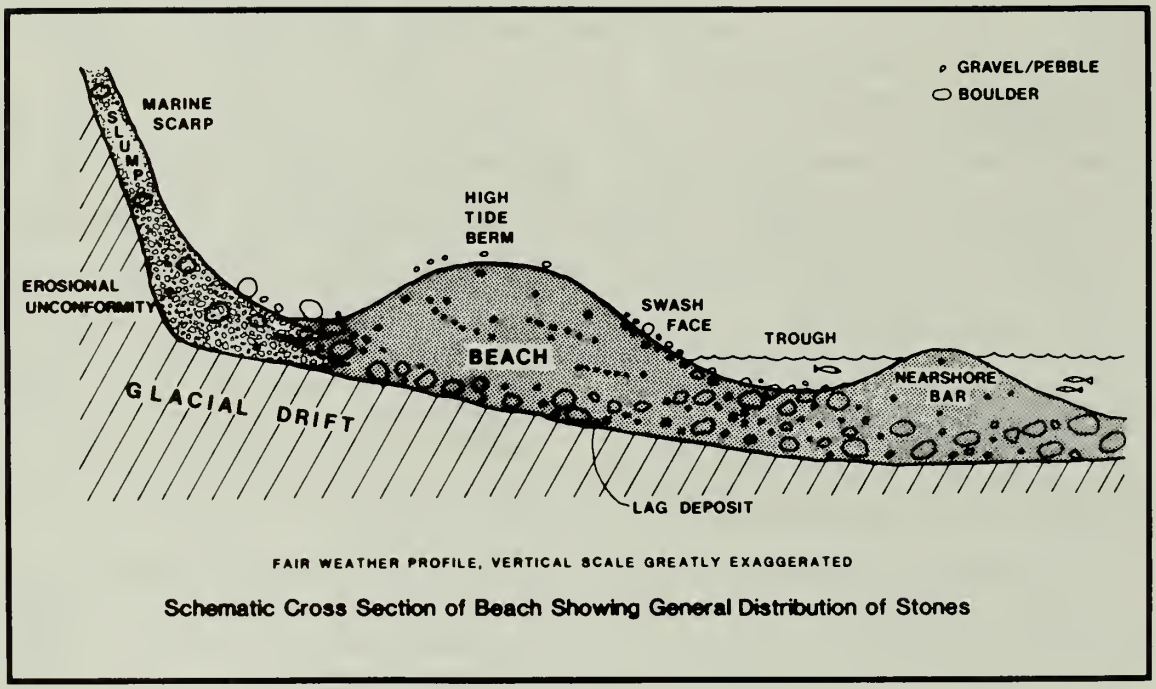
FIGURE 15.6

al. 1959; Zeigler and Tuttle 1961; Davies 1980: 111-114). Figure 15.6 illustrates the variation in the abundance of stones across the profiles at Coast Guard Beach and Head of the Meadow Beach (Truro) in early November, 1982. Both profiles show two areas where stones are common: at the toe of the cliffs and in the swash zone. Pebbles and cobbles are most abundant near the low tide line. Stones are rare in the backshore between the cliff base and the seaward end of the high tide berm.

This pattern of abundance is common under many sea states. Stones tend to be more abundant after a period of high seas than during an extended period of fair weather. During fair weather periods waves move sand onto the beach from bars offshore (Figure 15.7) (see also Strahler 1966; 30-34; Bascom 1964:184-212; Davies 1980:Figure 86). The sand is built into a broad berm in the backshore. Stones tend to be rare everywhere because they are buried beneath beach and nearshore sand; however, they are most common at the base of the cliff and the toe of the beach. During stormy periods waves move sand offshore. The beach profile lowers and becomes concave. Stones that have accumulated in lag deposits in front of the nearshore bar get spread onto the beach, and stones buried in the beach are re-exposed. Erosion brings additional stones onto the beach from the cliffs of glacial drift. Occasionally, sea and tide conditions combine to strip virtually all sand from the beach, exposing an extensive lag deposit of large cobbles and boulders lying on top of the drift beneath the beach (Figure 15.8) Zeigler, et al.(1964) report observing such conditions three times in ten years; from summer 1980 to spring 1984, I have observed this twice at Coast Guard Beach, but it may have occured more often.

In sum, coastal erosion provides Coast Guard Beach with a steady supply of pebbles, cobbles, and boulders. These are not equally available on all sections of the beach. Under many sea conditions they are common only at the base of the marine scarp and on the swash face. During some periods of stormy weather, stone abundance increases, as pebbles and cobbles are spread onto the beach from nearshore lag deposits. Sometimes, sea conditions are such that the glacial drift unerlying the beach is exposed. The base of the beach includes an extensive lag deposit of stones. Unfortunately, even the most ambitious effort to specify exactly what kinds of sea and weather conditions lead to what sort of beach profile changes was not completely successful (Zeigler et al. 1959; Zeigler and Tuttle 1961); hence, the generalized differentiation I used here between periods of fair and stormy weather.

Cook's Brook Beach (Table 15.1 and Figure 15.9) is typical of bayside beaches in Eastham. The beach is wider than those at Nauset Marsh, but narrower than the beach on



Schematic Cross Section of Beach Showing General Distribution of Stones

FIGURE 15.7

FIGURE 15.8

FIGURE 15.9

the outer Cape's Atlantic shore. A broad tidal flat is exposed at low tides. The maximum wind fetch is only about 110 km (to the Boston Harbor area), so waves tend to be smaller than on the ocean side. The length of the fetch and the fronting tidal flats mean that only moderately energetic waves wash against the beach. Erosion and changes in beach morphology take place, but at a lower rate than on the ocean beaches. Stones are moderately abundant.

In addition to these types of beaches, several other shoreline features could have provided raw material to prehistoric stoneworkers: spits, barrier beaches, and channels. All of these features are some distance from the eroding glacial drift that supplies them with sediment.

Distance is a key factor affecting the abundance of stones in these features. For example, stones are common along the short baymouth beaches that connect the islands of glacial drift (Griffin, Bound Brook, and Great Islands, and Great Beach Hill) in Wellfleet to one another. In contrast, stones are rare on Provincetown Hook, which stretches 8 km west-northwest of the terminus of the glacial deposits. The subaerial marine features, like Nauset Spit, the Wellfleet beaches, and the beaches of the Provincetown Hook, are subject to the same sorts of profile changes as Coast Guard's beach. As at Coast Guard Beach, these changes affect the abundance of stones on the spits and barrier beaches.

The strength of the currents shaping these features is another factor that affects abundance. Stony deposits are often seen near the seaward ends of spits, where the currents tend to be strongest. The beds of channels that bring tides into embayments were another potential source of raw material for stoneworkers. Currents tend to sweep away the finer material, leaving a stony bed. Where the water is shallow people could have searched the channel bottoms for cobbles and pebbles. Obtaining raw materials in this way would have been akin to wading and gathering shellfish.

Size, Shape, and Condition

Data Sources

Prehistoric stoneworkers on Cape Cod most commonly used quartz, quartzite, and felsic volcanic stones to make stone tools (see following section). At some of my stone collecting localities I also measured the stones of these materials that were picked up during the 10 min collections. The long, intermediate, and short axis lengths of these stones provide an indication of the size of the cobbles

available to prehistoric stoneworkers. Ratios of these measurements help describe the shape of stones (Pryor 1971; Shackley 1975: Chapter 5). The degree roundness of stones, which affects the techniques a stoneworker uses to begin shaping a cobble, is described using five classes: well-rounded, rounded, subrounded, subangular, and angular (Pryor 1971: Table 2).

I used a simple "stone board" to measure stones. This device is essentially a large pair of sliding calipers. It consists of two parts: a wooden board with a perpendicular stop at one end and an L-shaped slide (not actually attached to the long board). The long board is graduated in centimeters. The operator places a stone on the board between the slide and stop, and a dimension is read from the location of the stop on the long board. The stone is turned and another dimension is read.

Measurements of stones collected at three localities help illustrate the observations summarized in this section (Table 15.2). All of these localities are exposed to moderate (bayside beach) or heavy (Head of the Meadow and Coast Guard Beaches) surf during storms. The mid-beach is represented by one collection area with 22 stones. The base of the marine scarp has 113 stones from three collection areas. Stones from the base of the marine scarp have characteristics of shape, size, and condition like those in the drift, because they have not been altered by tumbling in the surf. Stones from this portion of the beach are also more or less representative of stones in protected sections of shoreline. One hundred sixty-two stones from three areas come from the swash face. The swash face of the beach is a zone where the turbulence of the surf can modify the shape, size, and condition of stones in various ways, as described below.

Size

Stones on the outer Cape range in size from the defined minimum dimension for the class (5 cm) to erratic boulders as large as Doane Rock, which rises 5 m above the ground surface. Table 15.3 compares the lengths of stones picked up during 10 minute collections at several localities. Most stones have lengths of roughly 5-15 cm and, as one would expect, frequency decreases as size increases. Of the three materials, quartz stones are on average the smallest. Quartzite stones average slightly smaller than felsic volcanic stones.

On exposed beaches like Coast Guard Beach large stones are most common when the layer of sand is thin. When the layer is thin, the lag deposit at the base of the beach is exposed (Figure 15.8). Even when this layer is exposed,

TABLE 15.2

General Characteristics of Stone Collections

Collection Locality and Area	Section of Beach Profile	Frequency of Stones[a]		
		Qtz	Qtzite	FV
Head of the Meadow Beach (Truro):				
Area A	Base of the marine scarp	19	4	30
Area B	Base of the marine scarp --southeast of Area A	11	2	27
Area C	Swash face at low tide --directly seaward of Area A	15	29	28
Area D	High tide berm (mid-beach) --directly seaward of Area A	3	7	12
Bayside Beach NW of Pond Village (Truro):				
Area A	Base of the marine scarp	3	8	9
Area B	Swash face at low tide --directly seaward of Area A	20	11	13
Coast Guard Beach (Eastham):				
Area B	Swash face at low tide	4	7	35

[a]Includes some clasts with lengths of less than 5cm.

TABLE 15.3

Lengths of Long Axes of Stones

Long Axis cm	Quartz	Quartzite	Felsic Volcanics	Total
4-4.9[a]	12	9	14	35
5-5.9	29	15	37	81
6-6.9	17	17	46	80
7-7.9	10	12	12	34
8-8.9	6	8	15	29
9-9.9	0	4	10	14
10-10.9	0	0	8	8
11-11.9	0	1	3	4
12-12.9	1	1	2	4
13-13.9	0	0	4	4
14-14.9	0	1	1	2
15-15.9	0	0	1	1
16-16.9	0	0	1	1
TOTAL	75	68	154	297

[a]See comment concerning clasts smaller than 5cm in section on souces of data for estimates of abundance of stones.

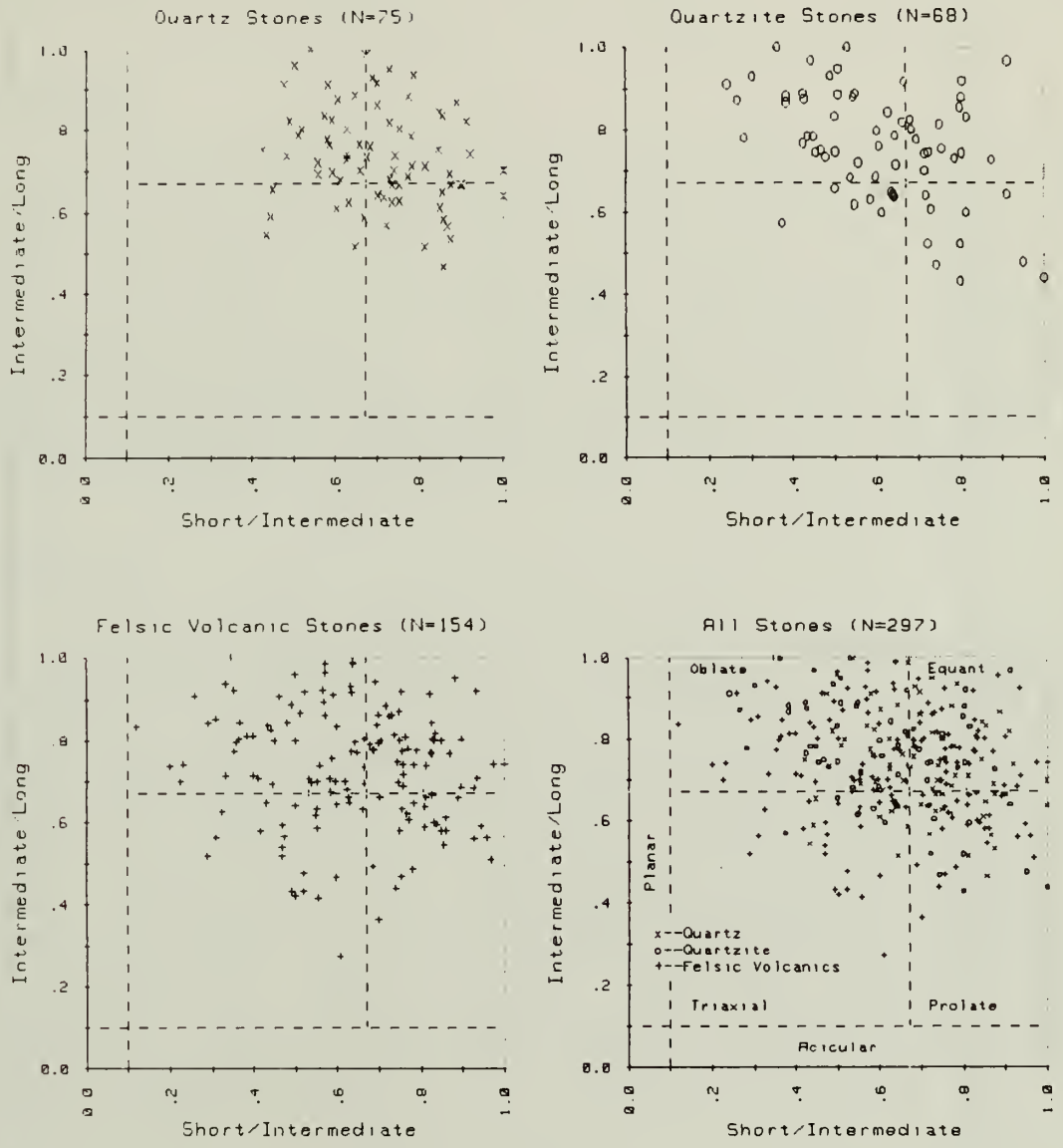
boulders larger than about one meter are infrequent. Boulders of this size are typically metamorphic greenstones, gabbros, or granites. Boulders of felsic volcanic rocks also occur, but quartz and quartzite boulders of such large sizes are quite rare.

Shape

Quartz, quartzite, and felsic volcanic stones come in a wide variety of shapes. Of the 297 stones included in Figure 15.10, 37.7% are oblate (disc-shaped), 34% are equant, 16.2% are prolate (blade-shaped) and 12.1% are triaxial (terms follow Pryor [1971: Figure 11]). Nearly half (49.1%) of the stones have intermediate: long and short : intermediate axis ratios of between 0.55 and 0.88. Modal stones have proportions of around 10:7.5:5 (long:intermediate:short axes--these are roughly the proportions of a stack of 12 issues of American Antiquity), but there is considerable spread around this mode (Figure 15.10). Very thin and very thin and narrow stones are virtually absent.

Rock type may somewhat influence stone shape (Figure 15.10), but various sampling difficulties make this only a tentative observation. In Figure 15.10 quartz stones have the most compact distribution and felsic volcanic stones have the most dispersed distribution. This difference may be partially due to sample size; twice as many felsic volcanic stones are shown in the figure as quartz or quartzite stones. Quartzite stones seem to have a higher proportion of oblate and prolate stones than quartz or felsic volcanics. This tendency may result from the source of most of the stones represented in the figure. A high proportion of the quartzite stones come from the swash faces of the beaches, where flattened stones are common.

The shape characteristics arise from several factors: the size of bedding planes in the source outcrop, the spacing of jointing (note the jointing planes that form major faces of the boulder in Figure 15.8) and other weaknesses in the rock, and the distance the rock was transported in the ice and in the meltwater. The turbulence and currents of the surf zone may also affect stone shape in a number of ways. Stones are abraded by sand grains and by other stones. Flattened stones may tend to stay in the surf zone longer than round stones because of their proportionally greater surface area. waves more readily pick up flattened stones from subtidal beach and move them shoreward. Figure 15.11 displays plots of axis ratios of stones collected at the toe of the marine scarp and at the toe of the swash face at Head of the Meadow Beach. Quartz stones from the swash zone show a tendency to be more discoidal than those from the toe of the cliff. Felsic



Pebble Shapes, Drift and Beach Sediments,

Outer Cape Cod

FIGURE 15.10

Shapes of Stones from Swash Face and Scarp Toe,
Head of the Meadow Beach, Truro

FIGURE 15.11

volcanic stones seem to have a similar pattern, but the two groups show more overlap. Differences in shape tendencies between drift and beach stone assemblages are common, but not all beaches show them. Factors responsible for the degree of difference between the two probably include the exposure of the beach and the sediment load characteristics of the waves and currents. Rock type may be another factor.

Roundness

Stones from the swash zone of the beach tend to be more rounded than those in the glacial drift (Table 15.3). The higher degree of rounding reflects the tumbling and abrasion that takes place as the stones are rolled in the surf. A small percentage of stones from the drift (none included in the counts in Table 15.4) are Pleistocene ventifacts (Strahler 1966: 89-90). These have weakly to strongly developed oblique angle facets on their faces. Typically these are best developed toward the center of face and are weaker towards the edges. Quartz ventifacts commonly have numerous pot-lid-like pits.

Condition

A large proportion of stones at a locality are not suitable for stoneworking. In addition to constraints imposed by the size and shape of stones, they may be unsuitable because weathering has deeply penetrated the rock, weakening the bonds between crystals; because of jointing, bedding, cleavage, or hairline fractures; or because of concretions or country rock adhering to the stone. Such flaws are often apparent to the stoneworker by visual examination alone, but frequently trial flaking is needed to determine whether a stone is suitable raw material for tool-making. The surf zone tends to have a higher proportion of useable stones than the glacial drift; tumbling of rocks in the surf tends to remove concretions, thick weathering rinds and the like, and tends to break apart unsound rocks.

Stone Lithology

Data Sources

From 1964 to 1971 Robert N. Oldale and his colleagues mapped the surficial geology of the Cape eastwards from the Sandwich and Cotuit 7.5 minute USGS quadrangles. These researchers employed stone counts to help differentiate drift units and found the counts particularly useful for the

TABLE 15.4

Roundness of Drift and Beach Stones

	Well Rounded	Rounded	Sub-Rounded	Sub-Angular	Angular	Total
SCARP TOE[a]						
Quartz[b]	1	2	5	6	0	14
Quartz-ite	1	2	7	4	0	14
Felsic Volcanic	1	5	14	38	8	66
Total	3	9	26	48	8	94
Percentage	3%	10%	28%	51%	8%	
SWASH FACE[c]						
Quartz	7	20	10	2	0	39
Quartz-ite	6	18	13	9	1	47
Felsic Volcanic	1	24	28	18	5	76
Total	14	62	51	29	6	162
Percentage	9%	38%	31%	18%	4%	

[a]Head of the Meadow, Areas A, B; beach N of Pond Village, Area A.

[b]Roundness not recorded for 19 quartz stones from Head of the Meadow, Area A.

[c]Head of the Meadow, Area C; beach N of Pond Village, Area B, Coast Guard Beach, Area B.

outer Cape. For Oldale and his colleagues stones include pebbles, cobbles, and small boulders, but not large boulders (R. N. Oldale, personal communication, 1982). Some of these data have been published in tabular and graphic form as part of the surficial geology maps for the outer Cape (Koteff et al. 1967; Oldale 1968; Oldale and Koteff 1970; Oldale et al. 1971). Dr. Oldale kindly loaned the National Park Service his unpublished field notes, which provide additional details relevant to archeological interests.

Most of the stone counts are samples of lag deposits at the bases of natural or man-made exposures. Such deposits contain a mixture of rocks from the height of the stratigraphic section. Oldale describes the field sampling procedure as follows:

> An attempt was made to collect stones systematically at 1-foot intervals along a 100- or 50-foot tape, or 50 to 100 stones within a square or circle of predetermined size. These methods proved unusable because the stones were too widely scattered. Most of the collections were made by picking up the first 50 or 100 stones encountered at an exposure. This technique may lead to errors in sampling, but in several places two counts taken independently by different people were similar and suggest that the method is sufficiently accurate [for mapping purposes] (1968:1).

Potential sampling errors include collector selectivity and small sample sizes. Such errors may be significant if the counts are used to characterize individual exposures. As Oldale notes, the samples are adequate for mapping entire drift units, and the patterns they reveal accord well with other characteristics of the drift units.

Drift Lithology

Stones in the Outer Cape's drift include a wide variety of rock types (Table 15.5). Individual drift units vary in their average lithologic composition, but some general patterns are evident. Granite tends to be the most common rock type. Typically, felsic volcanic and quartzite stones follow granic stones in abundance. Mafic volcanic (basalts and gabbros) and quartz stones are also common. In most of the drift units, schist, sedimentary rocks, and phyllite are uncommon. Hornfels and argillite, used by prehistoric people in other parts of New England, are rare or absent on the outer Cape. Chert comprises not more than a small fraction of one percent of the stones in the drift. Of the more than 12000 stones included in the counts in Oldale's unpublished notes, only one is explicitly described as

TABLE 15.5

Lithology of Stones Among Outer Cape Drift Units

Rock Type	Drift Unit: Truro Plain	Older Wellfleet Plain	Younger Wellfleet Plain	Eastham Plain	Nauset Heights Deposits	Harwich Plain
Vein Quartz	8%	15%	14%	12%	10%	10%
Quartzite	15	26	13	14	16	12
Felsic Volcanic Rocks	12	15	19	33	10	15
Granite	24	23	46	18	17	40
Mafic Volcanic Rocks	12	7	3	10	26	11
Schist	9	6	4	4	11	5
Gray Sedimentary Rocks	14	7	1	4	3	3
Red Sedimentary Rocks	5	1	t	t	1	t
Phyllite	--	t	t	5	6	4
N (Stones)	800	2400	800	2900	1300	1500
Source	(1)	(2)	(2)	(2)	(3)	(3)

Abbreviation: t - trace

Sources: (1) Koteff et al. (1967: Table 1)
(2) Oldale (1968: Figure 2)
(3) Oldale et al. (1971: Figure 2)

Notes: The Highland deposits are not included because this unit is small and dominated by silt. The younger Wellfleet plain deposits are "only a compositional variation of the Older Wellfleet plain deposits, as there are no significant morphologic or topographic differences between the two" (Oldale 1976:11). Granite includes pegmatite, aplite, and granite gneiss. Felsic volcanic rocks consist mostly of rhyolite and pyroclastic rocks. Mafic volcanic rocks include diorite, gabbro, and basalt. Schist also covers gneiss and greenstone. Vein quartz is microcrystalline quartz with few or no metasedimentary rock inclusions.

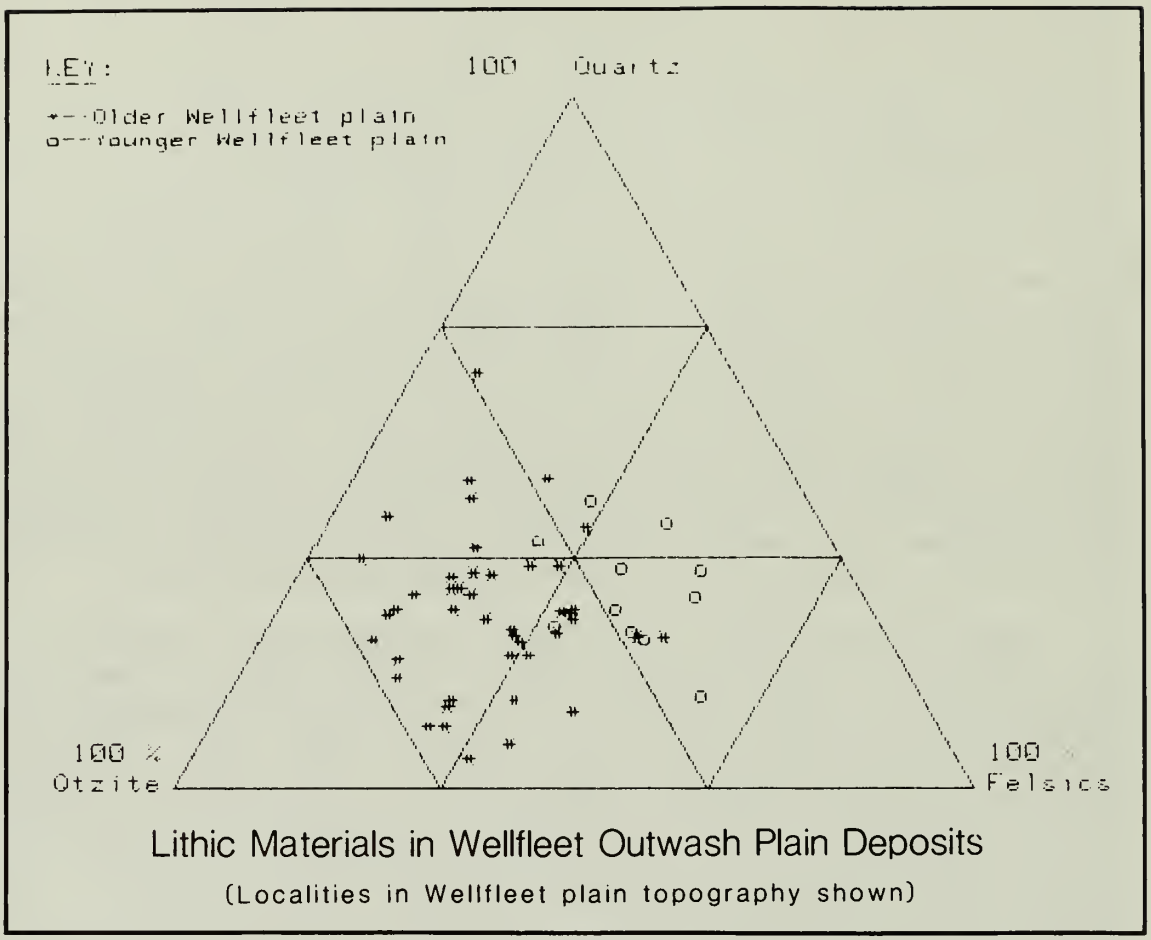
chert; a second stone is described as "silicified wood."

On the outer Cape prehistoric stoneworkers chose three materials--quartz, quartzite, and felsic volanic rocks--for making most of their chipped stone tools. Because of the importance these rock types, their distribution in the outwash deserves a closer look. Among the drift units of the Outer Cape, quartz stones are generally less frequent than felsic volcanic or quartzite stones (Table 15.5). This may be related to the size range under consideration: a substantial portion of the granule and sand fractions of the drift is quartz. The drift units are about evenly split between those in which felsic volanics are the most abundant of the triad and those in which quartzite is most abundant (Table 15.4). Quartzite stones tend to be more abundant in the northerly drift units, felsic volcanics in the southerly drift units. Overall, quartz stones occur in slightly more uniform proportions than quartzite or felsic volcanic stones. Additional feeling for the degree of variability in the proportions of rock types can be gained through examination of triangle diagrams for most of the individual drift units (Figures 15.12 and Figure 15.14-15.15).

Most of the drift units show substantial overlaps in the ranges of rock type proportions. Two areas where the variation in the drift has potentially interesting archeological implications are Nauset Marsh and Wellfleet Harbor. In both areas two drift units with somewhat different lithologies are adjacent to one another (Oldale 1979: Figure 3). The northern two-thirds of Nauset is within the Eastham Plain, while the southern third is part of the Nauset Heights deposits (Oldale et al. 1971). The Eastham Plain deposits show a high proportion of felsic volcanics while Nauset Heights has a high proportion of quartzite stones (Figure 15.14). Nearly all of the Wellfleet Harbor shoreline is part of the older Wellfleet Plain, but the younger Wellfleet Plain covers a small area in South Wellfleet near Blackfish Creek (Oldale 1968). The younger Wellfleet Plain deposits have a somewhat higher proportion of felsic volcanics than the older Wellfleet plain deposits. In each case, prehistoric stoneworkers searching for felsic volcanic might have found it advantageous to look along one part of the shoreline of these embayments for felsic volcanic rocks, while they might have found another portion of the shoreline more productive of quartzites.

Beach Lithology

Along protected shorelines the lithology of the stones on the beach should be identical with that of the parent drift. On exposed and moderately exposed beaches stone lithologies should be similar, but may not be identical



Lithic Materials in Wellfleet Outwash Plain Deposits

(Localities in Wellfleet plain topography shown)

FIGURE 15.12

because waves may selectively break apart rocks from some formations. This is suggested by the rock type proportions in Table 15.2; however, these data are insufficient to establish how widespread or how substantial these differences may be. In the absence of additional data, it seems best to regard the lithology of stones in the drift as representative of stones available to prehistoric stoneworkers in all shoreline settings.

Technological Considerations

Because no bedrock crops out on the outer Cape, lithic material is only available for stoneworking in the form of pebbles, cobles, and boulders. With the exception of very large boulders, prehistoric people would have made chipped stone tools using cobble-based (rather than bedrock-based) strategies. Two major approaches to tool-making using cobbles are possible: either the stone is the object piece or the stone is a core for the production of flake blanks.

In the first approach reduction aims to shape the stone into an implement. This strategy could be used to manufacture small thick implements and medium to large implements of varying proportions. Based upon the range of sizes represented by chipped stone implements in the survey's collections, this approach would have employed large pebbles and small to medium-size cobbles. Implements could have been either bifaces or unifaces, including, but not limited to, cobble tools such as "choppers". Stoneworkers would probably have preferred stones with flattish cross-sections (oblate stones and prolate stones with relatively high intermediate:long axis ratios) over more equidimensional stones. Such stones do not need to be extensively thinned to convert them into serviceable implements, and most of the stoneworker's effort can go into edge preparation. The roundness of stones would probably have had little influence over the reduction strategy unless the stone was relatively equidimensional and well rounded. Such stones tend to have oblique angle edges, which are difficult or impossible to use as striking platforms. The faceting of ventifacts might have offered the knapper a slight advantage in the initial preparation of a cobble. Ventifacts are not abundant and the their potential advantages are small, so knappers probably spent little special effort in searching for them.

Direct percussion and pressure techniques would be employed in making tools directly from stones. Major categories of debris from such manufacturing activities would probably include primary and secondary decortication flakes, thinning flakes, trim flakes, and failed tools; blocky debris would probably be rare (except for quartz which produces blocky debris abundantly).

In the second approach, the stone serves as a core. The initial steps in reduction aim to produce the flakes or blocks that serve as blanks for tool manufacture. Implements manufactured with this approach would range from small to large and would include both unifaces and bifaces. This might be the more commonly used strategy for the manufacture of small curated tools, such as projectile points. The entire size range of stones could be used, but the initial reduction techniques would vary according to the size of the stone. Bipolar approaches might be best for small stones. Medium size stones could produce blanks with free hand percussion or stone smashing approaches (or a combination). Large stones would first have to be reduced to manageable size by smashing them apart, and then these smaller units could be used as blanks or cores. Prehistoric stoneworkers probably approached the largest boulders using the kinds of techniques they used in quarrying bedrock outcrops.

Roundness would also be a factor affecting the choice of approach; for example, reduction of a rounded equant stone could only start once the stone was split (by bipolar or smashing strategies) to produce a platform. The best stones to use as cores are probably relatively equidimensional stones. Techniques employed would include direct percussion, pressure, and bipolar. Debris produced by this approach would include decortication flakes, thinning flakes, trim flakes, failed pieces, and an abundance of rejected large flakes and blocks. Exhausted cores might or might not be present; this would depend upon the stringency with which flake or block blanks were manufactured and upon the degree to which initial manufacturing simply aimed to quickly break apart a stone into useable blanks.

Of the major materials used by prehistoric knappers, felsite volcanic stones cover the widest size and shape range. Stoneworkers could have found felsite stones suitable for any strategy. Quartzite stones are slightly smaller on average than felsic volcanic stones and have a more restricted shape range. Quartzite stones might have been used somewhat more often as object pieces than as cores for the production of blanks. Quartz stones average considerable smaller than quartzite stones. This would certainly have affected reduction strategies stoneworkers employed on quartz.

Source Areas

Stones are widely distributed in the drift and in the marine sediments of the outer Cape, but not all places are equally suitable for the collection of raw material for

knapping. The abundance, shape, size, condition, and possibly the lithology of stones at potential sources, as well as the intended use of the implements, all would have influenced the choices prehistoric people make in regard to obtaining new material. These characteristics of the resource thus carry important implications for the outer Cape's archeological record.

In most places stones are not uncommon near the surface of the drift. Knappers could have dug quarry pits or scavenged bare ground around camps and in gardens. Both of these approaches would have required considerable work for the amount of material produced. In contrast, prehistoric stoneworkers would have found some natural exposures of drift and some deposits of sediments derived from drift to be productive and easily worked sources of raw material. Such exposures are limited to the shoreline of the outer Cape today, and would have been similarly limited in the past.

Stones tend to be most abundant along unprotected shorelines. These shorelines include the Atlantic coast between Coast Guard and Head of the Meadow Beaches and sections of the bayside shoreline. Erosion of unprotected drift continually adds fresh stones to those on the beach. Stoneworkers could regularly collect material in such areas and erosion would replenish the supply. Along protected shores, such as most of Nauset Marsh, knappers would quickly use up all the good quality material. Scavenging in camps and gardens has a similar effect. Erosion would not soon replace these stones.

On unprotected beaches the abundance of stones varies along and across the beach, as well as with time. Variations across the beach profile are consistent and predictable: stones tend to be most common at the base of cliffs and on the wash face. Variations in time relate to changing conditions of sea and tide. Modern efforts to relate changes in the outer Cape's beach profiles to specific meteorological factors have not been especially successful (Zeigler et al. 1959; Zeigler and Tuttle 1961). This does not mean that prehistoric p]eople could not have gained specific predictive insights about when stones were likely to be most abundant on the beach. However, if they had such knowledge, it came of long and careful observation. More likely prehistoric stoneworkers would have been aware of the general principles known today: stones tend to be rare on the beach after extended periods of fair weather, and are more likely to be abundant after storms and especially after extended periods of stormy weather. Thus, stones are more common on the beach from mid-autumn to mid-spring than during the warmer months of the year. even with knowledge of such generalizations stoneworkers would have had to go to a beach after a big storm to see whether

stones were common or not. One can imagine that word would spread from household to household (or camp to camp) when the beaches were good for stone gathering.

Stones from the surf were probably preferred for knapping. The rolling of stones in the surf tends to clean soft material (concretions and country rock) from the surfaces of cobbles and prevents marine organisms from adhering to them. Unsound cobbles tend to get broken up as they are rolled about. The surf zone also may contain a higher proportion than drift of discoidal stones, which require less effort for shaping into tools.

Abundances are also high in certain spits, bars, and channels. Some of these might be more consistent sources of raw material than the unprotected beaches, and might also have the technical advantages of beach cobbles.

In sum, the characteristics and abundance of stones on unprotected beaches suggests that the prehistoric stoneworkers probably obtained the bulk of their raw material from these and related shoreline features. They probably also used material picked up around camps and dwellings and in other less productive places, but such collecting would perhaps have been done on a more casual basis. What proportion of tool manufacturing was done on or near the beaches and what was done elsewhere is not known. Transport from source areas to beaches would not be a major problem because of the proximity of camps and because canoes were probably available. On the other hand, knappers typically carry out initial reduction or blank preparation near the source, to reduce the amount of material to be transported. Perhaps large cobbles were reduced or blanks were prepared from them while smaller stones were carried away with no preparation.

Over spans of thousands, and perhaps hundreds, of years the specific locations where stoneworkers did the bulk of their collecting changed. Through time erosion exposed and removed stony lenses of drift in various places. Changes also took place as the sea shaped the Cape into its present form. During the early millenia of the Holocene, the Cape had a more irregular outline, and there were headlands that had stonier beaches than most beaches today. Beaches on the outer Cape would have been stonier both because of the intensity of erosion along headlands and because the abundance of stones would have been greater in the ice contact sections of the drift formerly to the east of the outwash plains. Channels and bars shifted or disappeared with time.

The characteristics of lithic resources on the outer Cape carry several archeological implications. First, specific source localities cannot be identified. This is

due in part to the changes that have taken place in the coastline during the past several thousand years. It also reflects the widespread distribution of stones of specific rock types. Second, lithic reduction stations may be absent or underrepresented in the outer Cape's archeological record. Prehistoric stoneworkers are likely to have carried out initial reduction, blank preparation, or even later stages of tool making on beaches or on nearby cliff tops. Archeological evidence left on sea cliffs is sooner or later eroded onto the beach. Debitage left on the beach becomes water-worn and is eventually moved offshore. Underwater searches for evidence of seaside reduction stations would probably be an unproductive exercise, because of water rounding and an abundance of non-archeological lag deposits on the sea floor (Aubrey et al. 1982). The most productive approach for underwater survey might be to examine large boulders of suitable material. Such boulders are not likley to be moved far horizontally, but of course they will rotate and drop in elevation as the drift beneath them erodes. Although water rounding might well obscure the evidence, large boulders might show man-made fracture surfaces resulting from aboriginal efforts to quarry them.

Social Questions

The characteristics of the local lithic resources suggest several questions and speculations about social organization and exchange. Were local supplies of stones adequate to meet the needs of everyday tool making? I speculate that the answer is affirmative, but I also suspect that when populations were large, stoneworkers either had to be eclectic in the kinds of materials they used or had to go farther afield (but still in the "local" area) to obtain raw material. If it could be shown that local stones could and did supply local needs, then it seems plausible to infer that exchanged for non-local stone would have focused on materials for tools, with specialized functions or for high status items. Alternatively, the important aspect of exchange systems involving stone could well have been not the items themselves, but the act of exhanging them.

What was the composition of the task groups that procured stones locally? Collecting stones from the beaches requires neither great strength nor great skill. Skill is needed in determining which stones are of a suitable type and quality for knapping (especially based on cortex characteristics alone), but doubts can almost always be resolved by knocking a few trial flakes from a cobble. This ease of accessibility meansthat task groups could have been of a variety of sizes and compositions. Task group composition probably depended in part on the degree to which stoneworking was a special skill practiced by a segment of the community.

Finally, the wide availability of stones suggests that use of the resource would not have been controlled by resource-specific notions of property or territory. Any restrictions on the use of specific stone sources would have derived from notions of territory that were applied to many parts of the landscape. This contrasts with areas where stones came from restricted sources (e.g. bedrock quarries). In those situations it would have been possible for resource-specific ideas about territory to develop and for those claims to be enforced.

Archeological Observations

The remainder of this chapter focuses on the chipped stone artifacts and debitage from the 176 concentrations idenfitied in Chapter 3. These concentrations represent 17 sites. Unless otherwise noted, the data cited in this section are based upon excavations done between 1979 and 1981, and includes artifact frequences from only the uppermost in situ artifact-bearing layer in each unit (the identification of this "Stratum I" layer is described in Chapter 3). Lithic frequencies include only those specimens retained on 0.25 inch mesh screen. The 176 concentrations include 1270 test units--952 shovel test pits and 318 excavation units; 164 of the excavation units (including 161 50 x 50 cm units) were excavated at 19BN281. The uppermost soil layer from these 1270 test units produced about 51,309 chipped-stone implements and pieces of debitage. The number is approximate because it includes some estimated frequencies for arbitrary excavation levels whose boundaries did not correspond to soil layer (stratum) boundaries. No tabulation of ground stone tools has been made, but the number is small (less than 50, including hammerstones). The low frequency of ground stone artifacts is the reason this chapter gives them little attention.

Raw Materials Classification

The 51,309 lithics have been sorted, as part of the survey's cataloging procedure, into seven rock types. Table 15.6 is a summary of the characteristics employed by catalogers to classify the lithic materials. The categories are directly comparable to those employed by Oldale and his colleagues in their studyof stone lithologies. The types reflect general lithologic characteristics, and the classification scheme makes no effort to identify source formations. One reason for the generic approach of this classification scheme is the difficulty of accurately identifying the source formations. This takes considerable

TABLE 15.6
Lithic Material Definitions

Quartz: Transparent to opaque; gererally white; resinous to glassy luster; fracture varies from blocky to irregular to good conchoidal; chemical alteration on fracture surfaces not visible; hard.

Quartzite: Opaque, except along very thin edges; color variable and may be banded or speckled; generally has a sugary luster; generally fine-grained to very fine-grained with crystals homogenous in size and shape; fair to good conchoidal fracture; may include fossils.

Felsic Volcanic Rocks: Super fine-grained groundmass with phenocrysts of feldspar and quartz; quantity of phenocrysts varies; may have flow banding; cream colored weathering rind; fracture is somewhat irregular to fair conchoidal. Category includes four subdivisions.

Weathered felsic volcanic rocks: Subdivision has precedence over other three. Specimens show an overall light color on non-cortex surfaces, and surfaces are soft, chalky, and deteriorate readily.

Felsite: Includes two subdivisions--red-purple felsite and other felsite, distinguished according to the color of the groundmss. Distinctly reddish or purplish (Munsell hues of roughly 10RP to 10R) groundmasses are included in the former category. Groundmasses of all other colors are included in the latter category. When unweathered felsite has a dull to dull waxy luster; phenocrysts are phaneritic, but variable in size, and cover more than 5% of surface area (Compton 1962: [Appendix 2] has visual estimation charts); wet spcimens may show additional features, such as dark circular masses or flow structures.

Fine-grained felsic volcanics: Dull to waxy luster when unweathered; groundmass often very fine-grained to super fine-grained; phenocrysts of any size cover 5% or less of surface area; banding, flow structures or other volcanic features may be visible in dry or wet specimens. "Saugus Jasper," although a fine-grained felsic volcanic, is included in the chert category.

Chert: Cryptocrystalline quartz; color variable (includes black, gray, red, yellow, green, and brown); color may be uniform or may ocur as speckles, bands, clouds, or veins; opaque to subtransluscent; thin edges usually transluscent; luster dull waxy to waxy. Includes "Saugus jasper" by definition.

Other Fine-Grained Rocks: Fine-grained specimens that do not seem to fit any of the other categories. a re-examination of 128 (19%) of the flakes in this category showed that 81% were fine-grained felsic volcanics,and that only 8% ofthe total could not be placed in another category.

experience with the region's rocks and most of the survey's catalogers lacked this specialized experience. Providing sufficient training would be time consuming, especially considering the short periods of time most of the catalogers work for the Park Service. In addition, source idenfifications may be difficult without thin-section studies or characterizations of the chemical composition of the specimens. A second reason for the generic approach is that the most obvious and most probable source for raw lithic materials is the glacial drift and drift-derived deposits. Identifying rocks by formations would thus not necessarily identify the place from which prehistoric people obtained their raw materials.

The lithic material categories (Table 15.6) are designed to broadly describe the range of rock types prehistoric stoneworkers used. The major categories, quartz, quartzite, felsic volcanics, and chert, differ in certain characteristics important to knappers and tool users. These characteristics include the typical size and shape of the available cobbles, flakeability (tendency to fracture conchoidally, frequency and location of bedding planes or flaws, and so on) and durability under use. Some category distinctions are intended to carry potential chronological information (see also a later section of this chapter). This is particularly the case with the weathered felsic volcanic category, for Moffet (1957:1) noted that Archaic artifacts of felsite are commonly "patinated" or weathered. The survey's weathered felsic volcanic category is more restrictive than Moffett's term, patination. In his most explicit categorization of weathering on an assemblage of felsic volcanic artifacts, Moffett describes patination as ranging from slight to moderate to strong (1951: 48). Chert is a lithic material that is rare on the outer Cape and may have been brought into the area by trade or by quarrying expeditions. The other fine-grained category is a catch-all for rocks that catalogers could not identify with certainty. I re-examined a sample of 19% (128 of 671) of the other fine-grained lithics and found that 81% should be classified as fine-grained felsic volcanics. Of the remainder 5% (6) were quartzite, 6% (7) were varieties of chert, and only 8% (11) remained in the original category. Since not all of the other fine-grained lithics have been examined, the frequencies for this category have not been adjusted in the tables in this chapter.

The present classification scheme has evolved from an earlier system. The present scheme employs lot cataloging for debitage, while under the earlier debitage cataloging was item-based. Item cataloging produced a higher degree of inconsistency in the rock identifications for material from a single provenience, because pieces were examined individually. Lot cataloging allows the catalogers to sort flakes into groups, which show the range of variation for a

material, prior to cataloging. The earlier cataloging system also employed a number of color distinctions that have now been abandoned because they provided little useful information and could not be applied with consistency.

Overall Trends in Archeological Lithics

Table 15.7 enumerates frequencies and percentages for rock types at the 17 sites. Overall, felsic volcanic artifacts and debitage are most common (59.2%) followed by quartz (25.4%), and then quarzite (13.6%). Chert lithics are rare (0.5%). Other fine-grained lithics make up a larger percentage of the assemblages than chert does, but as noted above, the bulk of this material is probably fine-grained felsic volcanics. In the felsic volcanics category, other felsite and fine-grained volcanics are the common categories (28.7% and 22.3%, respectively). Red-purple felsites are rare (1.1%). Weathered felsic volcanics constitute 11.9% of all felsic volcanic lithics (7.1% of the 51,309 lithics in the table).

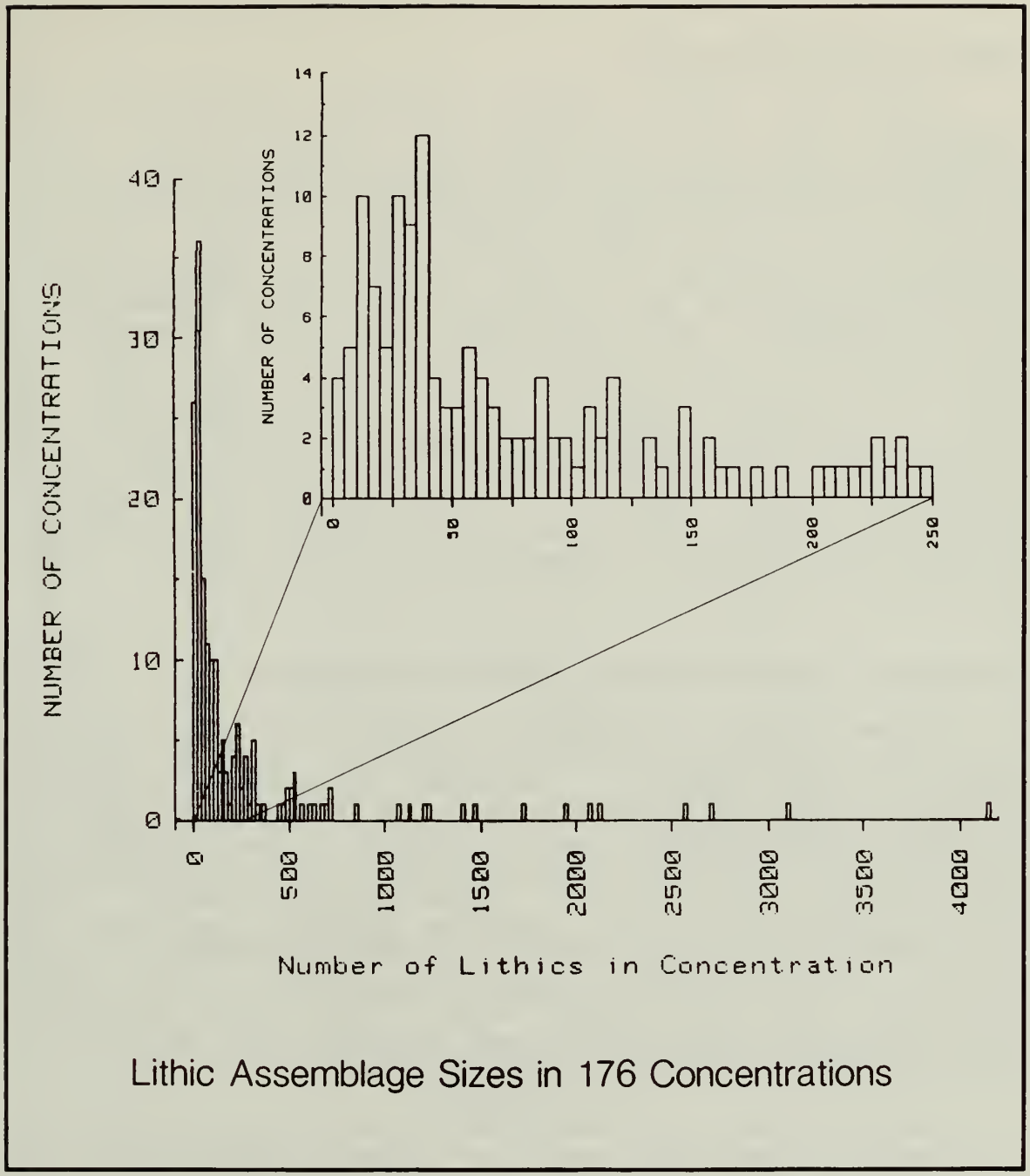
Individual sites are spread in a broad range around these overall trends. At least five factors may contribute to the percentage values for individual sites: site age, source areas, technology, assemblage size, and coding inconsistencies. Chronological and prehistoric cultural influences are most obvious in the quartz, weathered felsic volcanic, and chert categories. Late Archaic small stemmed point tradition components are more common in the Truro sites (19BN355, 356, 281, 282, and 169), which tend to have the highest quartz and weathered felsic volcanic percentages, than at Nauset. The highest chert percentage occurs at 19BN274/339, which has the best example of a Kipp Island-like Middle Woodland component. The significance of lithic raw materials to chronology is further discussed in a later section of this chapter, and site chronology is the subject of Chapter 8. Variation in drift lithology and differences in site function as reflected in the technological aspects of the debitage may account for some of the variation in quatzite, felsite, and felsic volcanic percentages. Site lithic assemblages range from 83 (19BN169) to 10,516 (19BN341). Deviations due to sampling error are possible in the small assemblages. Finally, classification errors and inconsistencies in lithic material definitions probably also contribute to some of the variation. The high percentages of weathered felsic volcanics at 19BN282/3/4 may be partially attributed to classification error, while the low proportion of weathered felsics at 19BN281 may be a product of the stringency of the definition of this category. Inconsistencies and definition dificulties are minor problems overall.

TABLE 15.7

Lithic Material Frequencies at 17 Sites

Site 19BN--	Q	Qtze	WeF	RPF	OtF	FgFv	Crt	OFg	Total
308	427 5%	2222 25.9%	370 4.3%	91 1.1%	2511 29.3%	2794 32.5%	52 0.69%	110 1.3%	8577
323	88 2.5%	488 14%	90 2.6%	103 2.9%	1520 43.5%	998 28.5%	20 0.6%	190 1.3%	3497
340	22 16.1%	21 15.3%	2 1.5%	1 0.7%	49 35.8%	37 27.0%	5 3.6%	0 0%	137
274339	547 21%	179 6.9%	102 3.9%	86 3.3%	853 32.8%	703 27.1%	88 3.4%	41 1.6%	2599
273/75	30 7.7%	43 11.1%	3 0.8%	11 2.8%	142 36.6%	150 38.6%	1 0.3%	8 2.1%	388
341	865 8.2%	1311 12.5%	201 1.9%	137 1.3%	4784 45.5%	3111 29.6%	9 0.1%	98 0.9%	10516
288	328 8%	401 9.8%	460 11.3%	70 1.7%	1325 32.4%	1306 31.9%	37 0.9%	162 4.0%	4089
390	152 15.9%	198 20.7%	117 12.2%	3 0.3%	354 37%	117 12.2%	5 0.5%	11 1.2%	957
333	22 4.9%	107 23.8%	8 1.8%	0 0%	177 39.3%	136 30.2%	0 0%	0 0%	450
336	115 9.2%	325 26.0%	94 7.5%	36 2.9%	362 29%	294 23.5%	2 0.2%	21 1.7%	1249
337	20 8.4%	18 7.6%	1 0.4%	1 0.4%	113 47.5%	72 30.2%	5 2.1%	8 3.4%	238
374	216 4.7%	1393 30.2%	53 1.1%	31 0.7%	1966 42.6%	920 20.0%	9 0.2%	21 0.5%	4609
355	294 88.6%	4 1.2%	14 4.2%	0 0%	6 1.8%	12 3.6%	0 0%	2 0.6%	332
356	1145 75.2%	35 2.3%	325 21.4%	0 0%	8 0.5%	10 0.6%	0 0%	0 0%	1523
281	7990 93.4%	35 0.4%	20 0.2%	0 0%	107 1.2%	399 4.7%	1 t	0 0%	8552
282/3	745 21.2%	174 5.0%	1756 50%	17 0.5%	441 12.5%	379 10.8%	1 t	0 0%	3513
169	20 24.1%	6 7.2%	7 8.4%	0 0%	33 39.8%	16 19.3%	1 1.2%	0 0%	83
TOTAL	13026 25.4%	6960 13.6%	3623 7.1%	587 1.1%	14751 28.7%	11454 22.3%	236 0.5%	672 1.3%	51309

KEY: Q-Quartz, Qtze-Quartzite, WeF-Weathered felsic volcanic, RDF-red-purple felsite, OtF-other felsite, FgFV-fine-grained felsic volcanic, CRT-chert, OFg-other fine-grained rocks (including unidentified).



Lithic Assemblage Sizes in 176 Concentrations

FIGURE 15.13

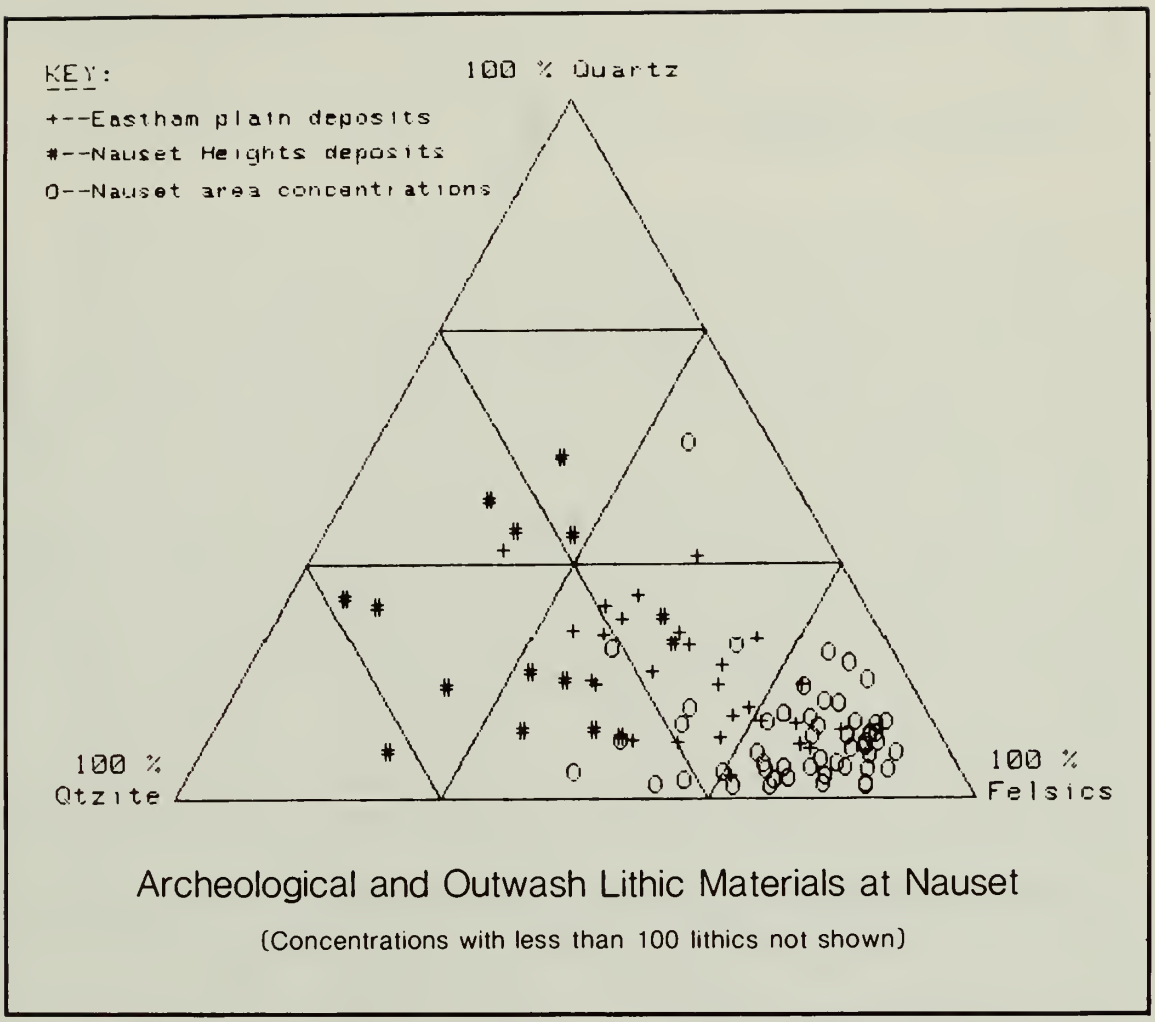
Using Concentration Data

Additional details about central tendencies and dispersion can be obtained by using data from concentrations. These are geographic subsections of sites defined on the basis of artifact density distributions (see Chapter 3). Unfortunately, assemblages for many of the concentrations are quite small (Figure 15.13). Small samples are likely to be highly deviant, so some minimum assemblage size must be set, below which the concentration will be excluded. The assemblages range from a total of three lithics to 4,157 lithics. The median is 79 and the mode is 32. The distribution is strongly skewed to the left. A minimum value of 100 lithics/concentration is selected for the subsequent discussions. Only 10 cases fall between this value and the median. One hundred items is a reasonably large sample for many statistical studies. McManamon uses the same value in his analyses (Chapter 9), but each of us chose it independently of the other. This threshold excludes 98 of the 176 concentrations.

Evidence of Use of Locally Available Materials

Three kinds of evidence support the notion that prehistoric people on the outer Cape used locally procured stones for tool making. Evidence includes similarities between natural and archeological rock lithologies, presence of decortication flakes, and presence of cortex on tools. A fourth kind of evidence, the existence of lithic procurement sites, is not obvious in the archeological record. One reason such sites are not readily apparent is that, as discussed above, stones are most abundant in rapidly eroding places. In addition, lithic procurement sites would presumably have been located where stones were abundant. The first three lines of evidence are discussed below, but all could be strengthened with more data.

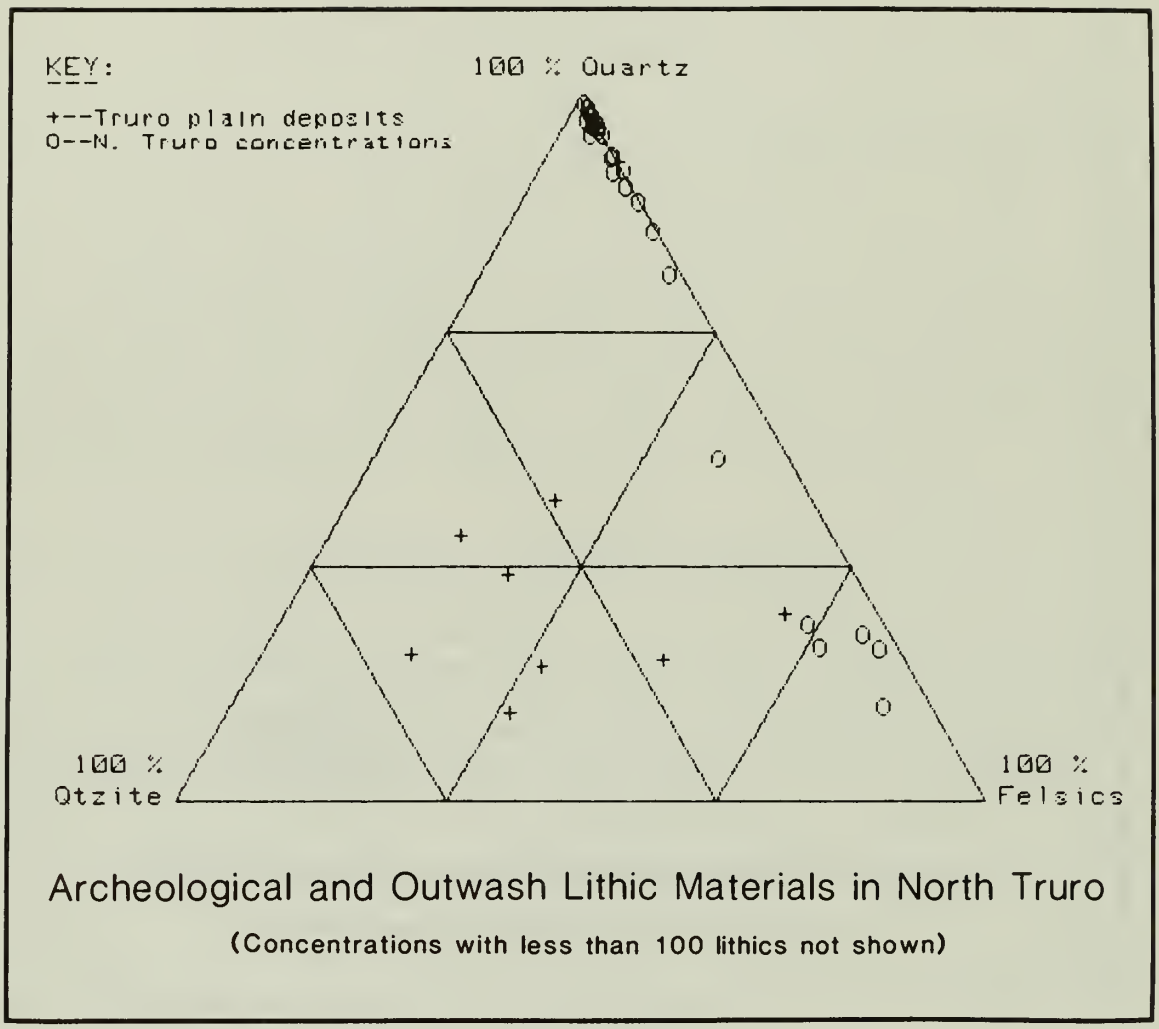
Unfortunately, the data that are presently available do not permit a quantified comparison between archeological and drift lithologies, except in a general fashion. Figure 15.14 makes such a comparison for the Nauset area. The Nauset concentrations have rock type proportions more similar to the Eastham plain deposits, on which the archeological sites are located, than to the adjacent Nauset Heights deposits. Although this similarity may reflect exploitation of the Eastham Plain deposits, normative preferences of tool makers strongly influence the pattern. On the whole, the archeological lithics are more tightly clustered than the natural drift stones, and archeological lithics suggest a preference for felsic volcanic rocks. Normative preferences are even more apparent in Figure 15.15, which compares the Truro archeological and drift



Archeological and Outwash Lithic Materials at Nauset

(Concentrations with less than 100 lithics not shown)

FIGURE 15.14



Archeological and Outwash Lithic Materials in North Truro

(Concentrations with less than 100 lithics not shown)

FIGURE 15.15

data. The Truro concentrations are dominated by Late Archaic components, and the strong preference for quartz during the small stemmed point tradition is clearly evident. Thus, broad scale comparisons are primarily indicative of prehistoric cultural preferences. The drift contained sufficient quantities of material to supply these preferences. On an impressionistic basis I would add that I have seen few felsic volcanic, quartzite, or quartz lithics in the survey's archeological collections that did not fall into the range of materials in the drift. Moffett's discussion of lithic materials leaves a similar impression (1944).

Decortication flakes in site assemblages are a second indicator of the use of local materials. All concentrations with over 100 flakes have decortication flakes. As used in the survey's classification, decortication flakes are those with any amount of cortex on the dorsal surface or platform. Decortication flakes indicate that stoneworkers were using cobbles as sources of raw material. It is unlikely that cobbles were traded onto the outer Cape from beyond because this would be inefficient. Cobbles contain too much material that must be flaked away to create a tool. The characteristics of the cortex on the flakes are similar to those of stones in the drift and on the beaches (e.g., presence of numerous crescentic impressions [resulting from tumbling in the surf?]), further supporting a local origin for these materials. The percentage of decortication flakes in concentration assemblages ranges from 1.4% (of 221 lithics--Concentration 282.22) to 12.7% (of 260 lithics--Concentration 308.41). The frequency distribution for decortication flake percentages is skewed to the left and seems to be bimodal (Figure 15.16). Concentrations at two sites --19BN281 and 19BN374-- contribute most of the percentages in the upper quartile of the distribution. This may indicate chronological differences between each of these sites and their respective neighbors or specialized stoneworking at these sites. Low percentages of decortication flakes indicate extensive use of exotic sources of rock.

A third kind of evidence is the presence of cortex on surfaces of other kinds of debitage and on finished implements. Cortex occurs on a minority of heavy duty (large, thick) and unfinished bifaces. Cortex is also common on chipped nodules (defined in Borstel 1982:34-37). Cortex is rare on well-thinned, apparently finished bifaces. No complete count of the frequency of cortex on bifaces has been made. Frequencies for two sites -- 19BN288 (where percentages of decortication flakes tend to be low) and 19BN374 (where percentages of decortication flakes tend to be high)-- indicate the range of percentages of cortex on bifaces. The 19BN374 data includes artifacts from the 1982 excavations. At this site none of the 17 projectile points

have cobble cortex. Fifteen of the 82 remaining bifaces have cortex on one or both faces or on an edge. Five of six nodules have cobble cortex, and the assemblage includes two modified cobbles and two large modified decortication flakes. At 19BN288 none of the eight projectile points has cortex, and only two of the remaining 29 bifaces have cortex. The single chipped nodule in the site assemblage has cortex.

Exotic Lithic Materials

Rock types that are not available from local sources are exotic materials. Such rock types in archeological assemblages are one indication of prehistoric interaction and exchange, or indicate the size of territories directly exploited by prehistoric people. Identification of implements that were not of local manufacture is difficult because of the wide variety of locally-occurring rock types on the outer Cape.

At present, material in only one category, chert, can be identified with confidence as exotic to the outer Cape. As discussed above in the section on natural occurrences, chert makes up a tiny fraction of one percent of the stones in the drift. The much higher percentage of chert in the archeological assemblages (averaging 0.5%, and ranging as high as 3.6%, as opposed to 0.02% naturally occurring) suggests that most of this material is imported.

The majority of lithics in the chert category are the so-called "mustard-colored" (Barber 1982) or yellow-brown jasper, commonly attributed to sources in the Mid-Atlantic region or Rhode Island. An examination of a sample of 24% (57 of 236) of the chert lithics showed that at least 35% of the lithics are yellow-brown jasper. An additional 23% (13) are reddish jaspers (not "Saugus jasper"), and for many of the lithics this color appears to be the result of heat-treatment of yellow-brown jasper. Seven percent (4) of the lithics in the sample are other varieties of North American chert; a cursory examination indicates that the 236 chert lithics include specimens that are visually similar to cherts from Munsungen Lake, Maine, New York State, and Flint Ridge, Ohio. Six flakes in the sample of 57 are similar to "Saugus Jasper." This material is probably exotic to the outer Cape, for I have not seen examples of it among local stones. For all of these materials more specific source identifications will require additional work, perhaps by thin section or by elemental analysis. However, these tentative source identifications suggest that, based on known sources, most of the chert and jasper in the archeological assemblages could not have been transported to the outer Cape by glaciers.

TABLE 15.8

Summary Statistics for Quartz, Quartzite and Felsic Volcanic Technological Categories for Selected Concentrations

QUARTZ (28 concentrations with 100+ quartz lithics)

	Minimum	25th%ile	Median	75th%ile	Maximum
Tr[a]	32.7%	47.7%	53.3%	62.0%	77.7%
ShBl	6.7%	16.1%	21.8%	26.6%	38.0%
Dec	3.0%	5.8%	8.0%	10.0%	12.8%
Fl + ThF	7.5%	10.5%	12.5%	15.9%	22.6%
BPURF	0.0%	0.9%	1.2%	2.0%	6.8%

Quartzite (15 concentrations with 100+ quartzite lithics)

	Minimum	25th%ile	Median	75th%ile	Maximum
Tr	47.8%	54.0%	73.6%	77.0%	83.0%
ShBl	0%	0.6%	1.0%	3.0%	5.4%
Dec	2.9%	6.1%	7.5%	8.9%	12.4%
Fl + ThF	11.9%	13.5%	17.4%	28.8%	38.1%
BPURF	0.0%	0.2%	0.5%	0.9%	3.1%

Felsic Volcanic
(48 concentrations with 100+ felsic volcanic lithics)

	Minimum	25th%ile	Median	75th%ile	Maximum
Tr	39.1%	64.9%	72.7%	78.7%	83.3%
ShBl	0.0%	1.2%	2.3%	3.3%	10.9%
Dec	1.0%	4.4%	6.2%	8.0%	14.0%
Fl + ThF	8.4%	13.6%	18.8%	22.5%	43.5%
BPURF	0.0%	0.3%	0.6%	1.3%	3.0%

[a]KEY: Tr-trim flakes, ShBl=shatter and block, Dec-decortication flakes, Fl + ThF-flakes and thinning flakes, BPURF-bifaces, points, unifaces, and retouched flakes.

The sample of 57 lithics also included three lithics of European flint, all from plowzones, and all probably gunflints or spalls. Seventeen percent of the sample (10 lithics) are fine-grained felsic volcanics, misclassified as chert. Finally, one flake (2%) is more appropriately included in the fine-grained other category.

The fine-grained other category also has some exotics. A sample of 128 (of 672) fine-grained other lithics includes four "Saugus jasper" flakes (3%), two yellow, brown, or red jasper flakes (2%) and one (1%) other North American chert. Hornfels, another material absent from the drift, is rare, represented by two bifaces and no flakes in the sample of fine-grained others. No Ramah chert (Fitzhugh 1972:40-42) occurs in the survey assemblages.

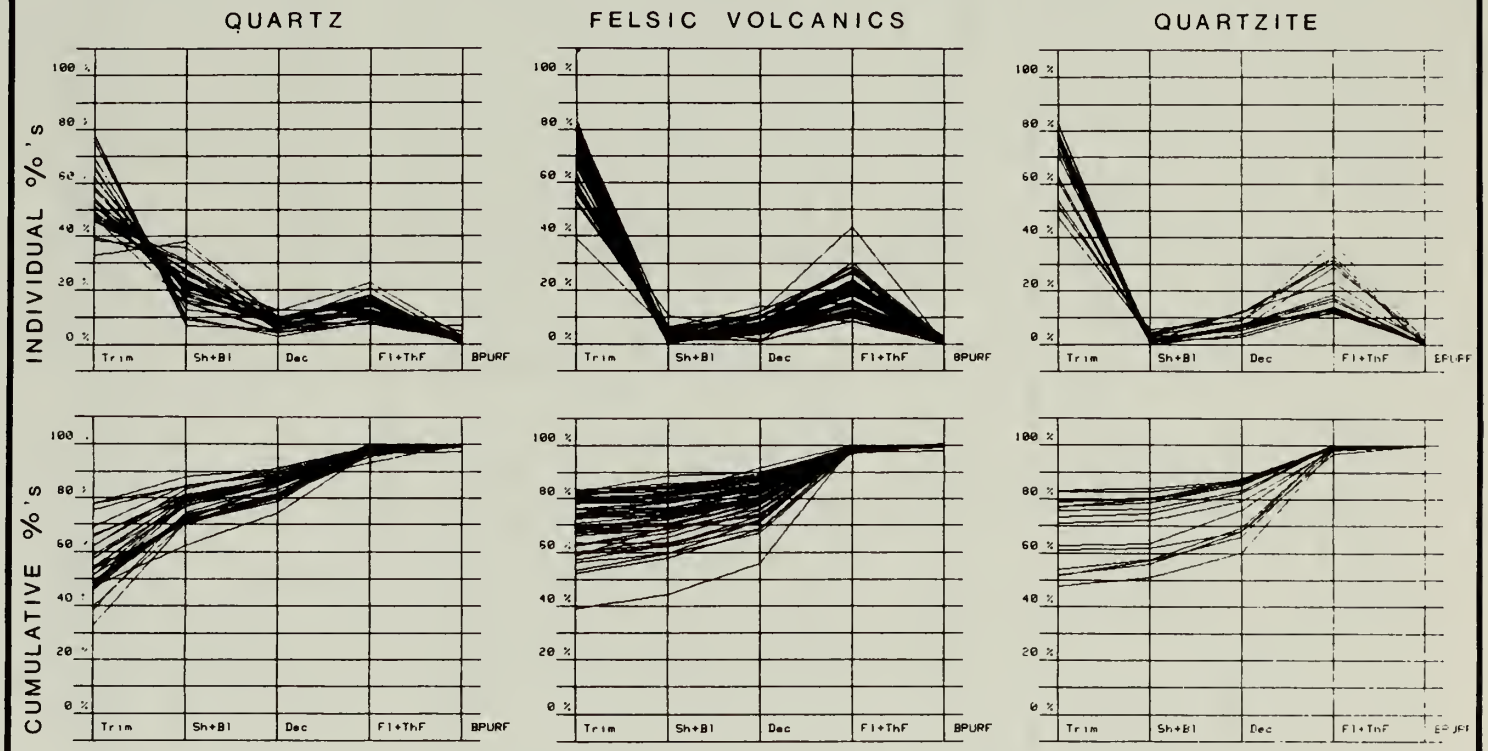
Technological Observations

The available data permit some general comparisons among proportions of technological categories for quartz, quartzite, and felsic volcanics. Figure 15.17 presents both individual and cumulative percentage graphs for the technological categories. Lines connect values for individual concentrations for each technological category. The felsic volcanic graph represents totals for all four subdivisions: felsite, red-purple felsite, fine-grained felsic volcanics, and weathered felsic volcanics.

Quartzite and felsic volcanics show similar patterns of technological percentages. Trim flakes are the most common category, followed by flakes and thinning flakes, decortication flakes, and shatter and block. Bifaces and other implements are the least common artifact category. Quartz differs from this pattern in having a higher percentage of shatter and block and a lower proportion of flakes and thinning flakes. This difference reflects the tendency of quartz to break into blocky fragments, and it may also reflect some differences in reduction strategies due to the average size of the small quartz pebbles. Table 15.8 provides minimum, maximum and quartile values for the data shown in Figure 15.17.

Table 15.9 summarizes technological frequencies for chert lithics. The 19BN274/339 data deserve a closer look since they are from a well defined, chronologically distinct assemblage. Nearly all are from Concentration 274.11. The assemblage is composed primarily of trim flakes (76% of 88), implements (11%) and flakes (9%); shatter and block and decortication flakes are rare and thinning flakes are absent. Indeed, the proportion of implements is the highest of any material in any concentration. The assemblage indicates that the material came into the sites as blanks or implements and that tools of this material were conserved

Technological Percentages For Quartz, Felsic Volcanics, & Quartzite



Key: Sh+Bl - Total of shatter + block; Dec - decortication flakes; Fl+ThF - total of flakes + thinning flakes; BPURF - total of bifaces, points, unifaces, & retouched flakes

Lines connect values for each concentration with each graph. Only percentages from concentrations with 100 or more lithics of the material is graphed.

FIGURE 15.17

TABLE 15.9

Technological Categories for Chert Lithics

Site	Trim	Flake	Thnng Flake	Decort Flake	Shttr and Block	Rtched Flake	Uni-face	Bi-face	Proj. Point
19BN308	34	14		1	1	1			1
19BN323	18	2							
19BN274	67	8		1	2	1	1	2	6
19BN340	5								
19BN273	1								
19BN341	5	1	1	1				1	
19BN288	36	1							
19BN390	5								
19BN336	2								
19BN337	4			1					
19BN374	7			2					
19BN281	1								
19BN282	1								
19BN169	1								
TOTAL	187	26	1	6	3	2	1	3	7

KEY: Thnng Flake-Thinning Flake, Shttr and Block-Shatter and'Block, Rtched Flake-Retouched Flake, Proj. Point-Projectile Point.

(curated) because they were hard to come by (cf. Feder 1981; Gardner 1974:5-6). It would be interesting to know why so many projectile points were abandoned at 19BN274/339 and what implements of chert were removed when the habitation was abandoned.

Although technological category proportions for each material vary from one concentration to another, there is a strong tendency to consistent proportions of categories. For example no concentration stands out as having a very low proportion of trim flakes and a very high proportion of decortication flakes or implements. This observation suggests that the cumulative proportions of different kinds of flintknapping activities carried out at different sites did not vary radically. Specific episodes of knapping at a site might have generated abundant decortication flakes and little else, but over time such episodes would have been balanced by others that generated mostly other debitage categories. Thus, on this gross scale no concentration or site stands out as being a place where initial lithic reduction or late stage reduction or tool use and curation took place exclusively.

Differences among concentrations are thus relatively small. Some differences deserve further investigation, but such explorations are beyond the scope of this chapter (See also Chapters 9 and 16). One difference already noted is the high numbers of concentrations at sites 19BN281 and 19BN374 that have relatively high proportions (in the upper 25%) of decortication flakes. Some concentrations in Figure 15.17 lie somewhat outside the average proportions of lithic technology categories. These also deserve a closer look. Because most of the sites to a greater or lesser degree represent a mixture of time periods and cultures it is difficult to discern changes in technological strategies through time that did not also involve shifts in lithic material preferences.

Chronological Implications

High frequencies of three rock types among artifacts (implements and debitage) carry some chronological information. For chert and quartz these implications are the result of the normative raw material preferences of prehistoric stone tool makers. For weathered felsic volcanics the chronological implications result from the length of time the artifacts were buried in the ground. Other materials may also be useful as chronological indicators, but these three are the most obvious ones.

Quartz. People of the Late Archaic small or narrow stemmed point traditions of eastern North America preferred to use locally available materials for stone tools. In many places

these Late Archaic people used quartz extensively, to the near exclusion of other materials. Ritchie (1969:214-218), for example, notes the prominence of a quartz pebble industry in the Squibnocket complex on Martha's Vineyard, and archeologists see similar patterns elsewhere (e.g., Feder 1981, Funk 1976:247-254; Kinsey 1959; papers in Barber 1981). Kinsey (1972:339) also observes that these same cultures frequently expressed "a negative preference... for fine-grained flints, cherts, and jaspers" (cf., Gramly 1981). Site 19BN281, a single component small stemmed point tradition site at High Head and Moffett's unpublished Freeman-Paine site in Wellfleet both show that these preferences also existed on Cape Cod. Although comparably unmixed sites for other time periods are in short supply on the outer Cape, sites like 19BN374 and 19BN410, both dominated by Late Woodland material, show low percentages of quartz. Thus, high percentages of quartz artifacts at a site or in a concentration indicate the presence of a small stemmed point component.

Chert. Cherts in the archeological sites on the Cape are almost certainly imported. Use of cherts during the prehistory of the Northeast is common enough but long distance importation is less common. The later Middle Woodland is a period when southern New England peoples actively imported chert (Feder 1981:196-197; Barber 1982:50-53). The Kipp Island-like component at 19BN274/339 (see Chapter 8) shows that this occurred on the outer Cape, too. Thus, relatively high proportions of chert may indicate the presence of a Middle Woodland component.

Weathered Felsic Volcanics. Moffett in several of his articles (e.g., 1957:1) says older (particularly Archaic) sites tend to have high proportions of felsic artifacts with gray "patination." The survey has produced no data that is adequate to evaluate Moffett's observations. Taking Moffett broadly, high proportions of weathered felsic volcanics on the Cape mean that we should suspect the presence of older (at least pre-Late Woodland) components. Exactly how old is unclear. Some caution must be exercised in using this criterion since the rate of weathering of felsic volcanic rocks probably depends on a number of factors, including temperature, moisture, and soil acidity. This last factor is especially important in New England. Soil acidity peaks in the podzolic (A2) horizon and felsic volcanics weather more quickly as soil acidity increases, so artifacts that have been in this horizon for considerable periods of time may be more heavily weathered than more deeply buried artifacts. (I observed exactly this pattern at the Young site [Borstel 1982] in central Maine. Younger Ceramic period felsite flakes tended to be more heavily weathered than the more deeply buried Late Archaic ones. A series of matching biface fragments from a Broadspear cremation pit showed varying degrees of weathering. The most heavily

Table 15.10

Concentrations with >100 Lithics and >10% Quartz
Ranked by Percentage of Quartz

Conc.	n STP	n EU	Total Lithics	Total Quartz	Quartz Tot. Lith.
288.51	9	1	245	25	.102
390.35	11	1	107	11	.103
308.41	6	3	260	27	.104
288.42	2	2	228	24	.105
390.31	2	0	102	11	.108
341.21	5	3	2717	303	.112
308.51	2	3	1125	133	.118
288.32	9	0	111	14	.126
336.14	3	4	719	92	.128
282.23	3	5	850	113	.133
288.41	5	1	119	16	.134
308.43	0	2	267	37	.139
288.63	0	1	116	19	.164
274.12	3	10	2139	386	.180
274.13	1	2	133	25	.188
390.34	7	1	111	23	.207
390.33	7	5	306	65	.212
282.24	2	5	1730	374	.216
282.41	6	1	332	73	.220
282.22	4	1	221	52	.235
282.42	4	3	147	37	.252
282.12	6	1	146	71	.486
274.22	4	3	212	106	.500
356.21	9	5	465	1098	.749
281.45	3	6	564	458	.812
281.43	1	3	708	604	.853
281.48	1	6	313	273	.872
355.12	4	1	269	239	.888
281.23	3	5	107	96	.897
281.22	1	2	13	125	.912
281.42	1	3	29	271	.916
281.14	1	5	314	296	.943
281.31	4	5	149	141	.946
281.46	1	5	1214	1157	.953
281.41	2	5	222	1169	.957
281.47	0	5	662	634	.958
281.33	4	9	494	476	.964
281.44	1	2	363	350	.964
281.34	2	5	177	171	.966
281.25	1	3	106	103	.972
281.15	0	3	164	160	.976
281.12	2	5	508	500	.984
281.13	1	5	539	534	.991

weathered pieces were close to ground surface in the A2 horizon.) Moffett himself was aware of the limitations of this criterion, for he wrote in reference to a projectile point from the Peaked Hill site: "A commentary on the reliability of weathering as an indication of age is afforded by the face that the halves of the... piece are of different shades"(1946:53).

General Comments. The strength of the inferences drawn from these three materials varies. High proportions of quartz seem to provide a strong, but admittedly, not certain indication of the presence of small stemmed components. Similarly, high proportions of weathered felsic volcanic rocks may indicate that a pre-Late Woodland component is present, but these proportions may arise from other factors as well.

Proportions of lithic raw materials increase in reliability as the assemblage size increases. One hundred lithics represents an arbitrarily set minimum figure below which the lithic material proportions are considered to be unreliable as chronological indicator.

The visibility of a component based upon these indicators depends partly on the relative intensity with which different people of prehistoric periods used an area. Low intensity of use makes components invisible. For example, suppose small stemmed folk used an area only a little (depositing few quartz artifacts) and a later Woodland people used a site intensively (depositing numerous non-quartz artifacts). The precentage of quartz would be small, and we could not say with confidence that the proportions of quartz artifacts suggested the presence of a Late Archaic component.

No claim is made that every artifact of a particular material category dates to a particular period. These raw material criteria apply only to groups of artifacts, not individual specimens. These trends result from modes of past human behavior.

Setting the Thresholds. Reliability for chronological inferences increases both with assemblage size (as noted above) and with higher percentages of the respective materials. For each material some arbitrary percentage value must be set below which no confident inference is possible. Histograms (not shown) that plot number of components (with 100 or more lithics) against percentage of material have similar shapes for each material. The distributions are all strongly skewed to the left. Most concentrations have relatively low proportions of these materials, but a few have higher proportions. (Quartz even shows a bimodal trend, due to the single component 19BN281.) Values for these concentrations generally cover a wide

TABLE 15.11

Concentrations With >100 Lithics and >1% Chert
Ranked by Percentage of Chert

Conc.	n STP	n EU	Total Lithics	Total Chert	Chert / Tot. Lith.
390.33	7	5	306	3	.010
323.21	4	3	488	5	.010
308.42	3	8	691	8	.012
288.51	9	1	245	3	.012
288.31	12	1	524	8	.015
288.52	3	4	1062	19	.018
337.11	3	5	238	5	.021
308.33	10	0[a]	209	6	.029
274.13	1	2	133	4	.030
308.71	4	4	218	8	.037
274.12	3	10	2139	83	.039
308.43	0	2	267	21	.079

[a]EU 300 is within Concentration 308.33, but these data have not yet been incorporated into the analysis.

range. An appropriate threshhold value would seem to lie in each about where the frequency distribution flattens out. The histograms indicate that the following percentages are suitable threshholds: quartz, 10%, chert, 1%, and weathered felsic volcanic, 5%.

Tables 15.10 through 15.12 list the specific values for each concentrations that exceed these threshholds. Two comments are in order. First, although chert ranges from 1% to 7% the absolute frequency of chert artifacts is in most cases quite low. Thus, the percentages for most of the concentrations should be used with considerable caution, and chert percentages provide reasonably strong evidence of Middle Woodland components only when the frequency of chert flakes is relatively high (i.e., in concentrations 288.52, 274.12, and 308.43). Second, the proportion of weathered felsic volcanics is extremely high at 19BN282. A superficial re-examination of some of the flakes from this site indicates that cataloguers made the category more inclusive at 19BN282 than at other sites. However, even using the correct, more restrictive definition for this category would still produce a substantial proportion of weathered felsic volcanics. Time may also not be the only factor responsible for these high proportions at 19BN282. The soil profiles at this site were generally bleached in appearance, possibly indicating extensive leaching and high acidity.

Summary

This chapter has described the characteristics of the local natural resource employed by prehistoric stoneworkers, and it has discussed some aspects of archeological assemblages of lithic debitage and tools. Stones of various materials suitable for knapping are widely distributed in the outer Cape's glacial drift. The most productive places to obtain pebbles, cobbles, and boulders are not in the drift itself but in shoreline deposits derived from drift. Areas where erosion is rapid are the sources where abundance of stones is highest and where stones removed for knapping are quickly replaced with new material. Lithic procurement sites in such settings would be quickly destroyed by erosion, so this category of site is probably absent from the archeological record on the outer Cape.

Prehistoric peoples used locally obtained stones of quartz, quartzite, and felsic volcanics for tool making. The cumulative effects of their tool making and maintenance has been to produce lithic assemblages composed (within a given material) of relatively similar proportions of technological categories. Prehistoric people, during some

TABLE 15.12

Concentrations With >100 Lithics and >5 % Weathered Felsics
Ranked by Ratio of WeF's to Total Lithics

	n STP	n EU	Total Lithics	Total Felsics	Weathered Felsics	WeF[a] / T-Lith	WeF[b] / T-Fel
390.35	11	1	107	70	6	.056	.086
390.33	7	5	306	179	17	.056	.097
288.31	12	1	524	432	35	.067	.081
308.34	10	1	636	514	49	.077	.095
390.34	7	1	111	48	9	.081	.188
336.14	3	4	719	414	82	.114	.198
288.55	11	0	156	134	19	.122	.142
288.51	9	1	245	195	32	.131	.164
288.53	4	1	131	98	19	.145	.194
308.51	2	3	1125	775	184	.164	.237
356.21	0	5	1465	340	324	.221	.953
288.52	3	4	1062	772	284	.267	.368
282.42	4	3	147	96	47	.320	.490
282.12	6	1	146	62	47	.322	.758
282.22	4	1	221	161	89	.403	.553
282.24	2	5	1730	1311	813	.470	.620
282.41	6	1	332	227	159	.479	.700
390.31	12	0	102	85	62	.608	.729
282.23	3	5	850	684	569	.669	.832

[a]Weathered Felsics/Total Lithics

[b]Weathered Felsics/Total Felsic Volcanic Lithics

time periods, imported small amounts of chert from probably distant sources to supplement the locally-obtained materials. High proportions of chert, weathered felsic volcanic rocks, and quartz are all potential chronological indicators. High proportions of chert suggest Middle Woodland components; high proportions of quartz provide evidence of Late Archaic small stemmed point components; and high proportions of weathered felsics suggest early (i.e., pre- Late Woodland) components.

Obviously, the data in this chapter could be strengthened in a variety of ways, and the analyses of archeological assemblages could be extended. McManamon in Chapters 9 and 16 in this volume reports additional analyses of the lithic data. Further work could be done through a thorough technological study of bifaces, projectile points, and other implements. More specific data on the types of quartz, quartzite, and felsic volcanics in the drift needs to be gathered. It might then be possible to identify additional artifacts of exotic materials in the archeological assemblages and to better understand the criteria employed by prehistoric stoneworkers in the selection of local rocks for tool making. Unfortunately, analyses of tools and debitage at most sites will always be hampered by our inability to separate the bulk of the assemblage into its original chronological components.

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CHAPTER 16

Prehistoric Cultural Adaptations and their Evolution on Outer Cape Cod

Francis P. McManamon

Interpretations of Prehistoric Activities

This chapter aims to synthesize the prehistoric data presented in earlier chapters and to present an interpretation of cultural adaptations and their temporal variation during prehistory. Cultural adaptations are described using the niche model presented in the first part of Chapter 5. This interpretation is for the most part based upon only the 1979-1981 data. Therefore the interpretation, while probably accurate in its overall construction, is likely to require modification in some details.

In the first sections of this chapter data on the density and types of ceramics, faunal and floral remains, shell, fire-cracked rock (fcr), and lithics are summarized and combined to identify the types of archeological deposit and the predominant prehistoric activities associated with different concentrations. Chapter 9 presented the basic descriptions and examination of deposit types and the lithic assemblages. The next section of this chapter describes the prehistoric ceramic remains and the activities that they represent. More detailed descriptions of these ceramics can be found in Chapters 13 and 14. Similar brief descriptions and assessments of the shellfish, faunal and floral remains are in following sections. More detailed descriptions of these can be found in Chapters 11 and 10, respectively. In subsequent sections the activity and deposit types are summarized and the interpretations for a sample of the concentrations are presented.

Prehistoric Ceramics

Prehistoric ceramics were found in 65 of the 176 concentrations that have been analyzed here (Table 16.1). The ceramics, for the most part, are tiny sherds, although in a

TABLE 16.1: Amounts of Prehistoric Pottery/Concentration by Temper Type (N=65 concentrations; all weights are in grams)

	Temper Type			
Concentration	Grit	Shell	Mixed	Total Pottery
308.11	--	11.0	.7	11.7
.14	--	14.9	.4	15.3
.15	--	.2	--	.2
.21	--	49.7	.5	50.2
.22	--	3.8	--	3.8
.23	--	.2	--	.2
.26	--	.3	--	.3
.31	.3	3.1	.6	4.0
.32	.7	2.0	--	2.7
.33	.8	30.6	--	31.4
.34	1.0	1.8	.9	3.7
.41	--	1.7	--	1.7
.42	12.5	84.4	65.8	162.3
.43	--	13.2	--	13.2
.51	--	9.0	.3	9.3
.52	--	.7	--	.7
.71	33.8	128.6	--	162.4
.72	--	2.8	--	2.8
323.12	46.0	--	--	46.0
.21	--	2.9	--	2.9
.22	5.8	138.1	--	143.9
.23	.2	2.8	--	3.0
.24	--	1.0	--	1.0
273.31	.4	47.9	7.9	56.2
.32	--	.7	--	.7
274.12	--	798.1	4.1	802.2
.13	--	2.7	--	2.7
341.21	13.4	134.6	6.4	154.4
.22	--	.9	--	.9
.23	1235.0	146.4	2.2	1383.6
.24	11.7	403.0	3.2	417.9
.26	1.4	2.0	--	3.4

TABLE 16.1 (continued)

Concentration	Temper Type: Grit	Shell	Mixed	Total Pottery
288.11	--	1.9	.4	2.3
.21	--	3.4	.9	4.3
.22	--	.4	.2	.6
.23	--	.4	--	.4
.31	--	24.0	--	24.0
.33	--	1.4	--	1.4
.41	--	2.7	3.7	6.4
.42	10.9	11.3	2.7	24.9
.43	--	.5	--	.5
.45	--	4.2	--	4.2
.51	--	.2	6.2	6.4
.52	--	42.2	1.2	43.4
.53	2.3	3.0	--	5.3
.54	2.1	.2	--	2.3
.55	--	1.8	.1	1.9
.57	--	.6	--	.6
.63	--	.5	--	.5
390.23	--	--	1.9	1.9
.31	--	.5	--	.5
.33	149.5	56.8	135.8	342.1
.34	15.1	2.3	--	17.4
.35	2.7	.4	.2	3.3
333.11	.5	3.8	--	4.3
336.11	.7	4.4	--	5.1
336.12	1.5	5.4	--	6.9
336.14	--	2.3	--	2.3
337.11	.3	--	3.4	3.7
374.21	.5	3.9	--	4.4
.24	--	5.1	--	5.1
.43	--	16.5	--	16.5
.44	--	26.0	2.3	28.3
.46	4.4	8.8	--	13.2
.54	--	.5	--	.5

detailed technological, morphological, and stylistic analysis Childs (1982, this report:Chapters 13 and 14) has been able to identify vessel lots associated with many of the concentrations. Table 16.1 reveals a wide range of weights for ceramics, from less than a gram to over a kilogram. There are eight concentrations with over 100 g of pottery, while a majority of the concentrations have less than 10 grams (Figure 16.1, Table 16.2).

In her technological analysis of the pottery, Childs (Chapter 13) saw little evidence of careful attention on the part of prehistoric potters to the preparation of paste and temper mixes that would result in durable pots. She also found that nearly half of the vessel lots she identified had coil breaks, indicating a similar lack of attention to the creation of strong, well-bonded walls during the process of forming the vessel (Table 16.3). Given these kinds of characteristics, Childs concluded that prehistoric ceramics were, for the most part, made rather expediently without much concern for durability. These kinds of characteristics, plus the rather infrequent occurrence of pottery among the archeological remains, suggest that it was not used regularly in a wide range of activities.

Childs (Chapter 13) also found that 28% of the vessel lots she identified had interior surfaces at least partially covered by a residue that appeared to be carbonized food (Table 16.3). Pottery remains, then, seem to be rather directly linked to cooking. This might have been the only activity with which pottery had any substantial connection. Considering the abundance of other materials that were readily available to make containers for storage or transport it would be understandable if pottery never or rarely served those functions. This seems to have been the case at the time of the European contact. For example, consider the inventory of contents of a native house on the outer Cape searched by a band of reconnoitering Pilgrims in December of 1620 (Mourt 1622:29):

> In the houses we found wooden bowls, trays and dishes, earthen pots, handbaskets made of crabshells wrought together, also an English pail or bucket....There was also baskets of sundry sorts, bigger and some lesser, finer and some coarser; some were curiously wrought with black and white in pretty works, and sundry other of their household stuff...also two or three baskets full of parched acorns, pieces of fish, and a piece of broiled herring.

Although noted, the native pottery, at least in this instance, seems to be undistinguished in frequency or decoration. It stands in contrast to the apparent abundance of wooden implements and basketry, some of the latter even having notable black and white designs. Another ethnohistoric account, this one by William Wood in 1634 (Vaughan 1977:86-88, 108-109), indicates a similar neglect of native ceramics. Wood's list of the "arts and manufactures" of New England natives includes: hides and skins,

TABLE 16.2: Concentrations with More Than 100 g of Prehistoric Pottery

	Amount of Pottery by Temper Type[a]			
Concentration	Grit	Shell	Mixed	Total
323.22	6	138	--	144
341.21	13	135	6	154
308.42	12	84	66	162
308.71	34	128	--	162
390.33	149	57	136	342
341.24	12	403	3	418
274.12	--	798	4	802
341.23	1235	147	2	1384

Note

[a] Differences in weights from Table 6.1 are due to rounding.

TABLE 16.3: Frequencies of Coil Breaks and Carbon Residue on Prehistoric Pottery

	Number of Vessel Lots		
Site	Site Total	With Coil Breaks	With Carbon Residue
19BN308	32	15	5
19BN323	8	2	2
19BN273	7	4	1
19BN274	6	3	0
19BN341	27	16	19
19BN288	14	10	1
19BN390	11	3	2
19BN333	2	1	0
19BN336	7	4	0
19BN337	2	0	0
19BN374	9	3	5
	125 (100%)	61 (49%)	35 (28%)

Frequency	Weight of Ceramic Remains (in grams)	Scores
13	<1.0	2,2,3,4,5,5,5,5,6,6,7,7,9
30	1- 9	1,1,2,2,2,2,2,2,3,3,3,3,3,3,3,4,4,4,4,4,4,4,4,5,5,5,6,6,7,9
6	10-19	12,13,13,15,17,17
3	20-29	24,25,28
1	30-39	31
2	40-49	43,46
2	50-59	50,56
-	60-69	
-	70-79	
-	80-89	
-	90-99	
8	>100	144,154,162,162,342,418,802,1384
65		

FIGURE 16.1: Stem-and-Leaf Display for Total Ceramic Remains (N=65 concentrations; weight rounded to nearest gram)

bows, arrows, cordage, fish nets, and canoes, but no mention of ceramics. Two instances do not a pattern make, but it certainly supports the conclusion drawn by Childs from her analysis.

For all these reasons, the presence of large amounts of prehistoric pottery in a concentration was taken as an indication that substantial cooking activities occurred in or near the concentration. The other kinds and amounts of remains relative to the pottery also were considered in the interpretation of activities represented by the remains of each concentration. These interpretations are presented in the later sections of this chapter.

Faunal and Floral Remains

Non-shellfish faunal remains were investigated separately from the shellfish remains because they indicate a different set of activities and they occur in the sites examined here far less frequently and in smaller amounts than the shell remains.

Faunal or floral remains were recovered at nine sites. Some of the remains were found during hand excavation of general levels in excavation units, others were recovered by the flotation of soil samples from features. These data are not completely tabulated yet; however, for 39 concentrations in four sites the remains have been sorted and can be compared. Eight general categories were used for this initial description of the remains: bird, fish, mammal, other, unidentified, carbonized seeds and carbonized nuts (Chapter 10). The extent of these remains in individual concentrations is shown in Table 16.4. Inspection of this table and a frequency distribution of total faunal remains (Figure 16.2) indicate that only in a few concentrations were faunal remains over 100 g recovered.

Floral remains were rarer still, recovered in only four of the general excavation levels (Table 16.4). This is not surprising, given that most of these remains are smaller than the 1/4-inch mesh size of the screens used for sifting the test unit soil. The flotation soil samples included a far higher relative frequency of floral remains. Floral material was recovered by flotation in eight out of the nine concentrations where flotation of soil samples was done. Soil samples for flotation were taken mostly from subplowzone features. There is a prevalence of both faunal and floral remains in these features (Table 16.4), and, for faunal remains at least, a much greater density of material than in the general excavation levels.

The faunal and floral classes used for this analysis are general, and relatively substantial remains should be present for comparisons to be valid. Therefore, further analysis will focus upon those concentrations with more than 100 g of faunal remains, those with floral remains, and those with flotation data (Table 16.5).

TABLE 16.4: Faunal and Floral Remains from 4 Sites[a]

	Hand Excavation			Flotation		
Conc.	Volume Excavated (cubic cm)	Total Fauna (g)	Flora (p/a)[b]	Volume Floated (cubic cm)	Total Fauna (g)	Flora (p/a)
308.11	1,107,723	26.3	a	--		
.12	432,239	.4	a	--		
.14	1,062,599	14.5	a	--		
.15	384,586	.4	a	--		
.21	871,049	32.5	a	31,900	4.1	p
.22	472,021	2.6	a	--		
.32	268,032	3.8	a	--		
.33	2,790,173	661.8	a	40,000	56.3	p
.34	735,977	2.4	a	--		
.41	2,325,328	2.1	a	--		
.42	3,399,964	512.1	p	138,600	42.3	p
.43	1,130,000	13.8	a	--		
.51	1,143,144	40.9	a	--		
.52	803,840	3.8	a	--		
.71	327,623	256.5	a	45,738	81.5	p
274.12	5,883,884	102.6	a	17,495	2.4	p
.13	808,888	.4	a	--		
.31	1,020,514	.9	a	--		
341.21	2,227,116	665.8	p	6,066	8.4	p
.22	559,639	1.4	a	--		
.23	2,388,087	219.0	a	3,091	8.1	p
.24	4,761,709	267.6	p	33,390	2.4	a
.25	195,312	2.3	a			
.26	143,864	3.0	a			
288.11	1,289,567	trace	a	3,568	0	p
.22	479,026	5.6	a	--		
.23	207,571	.3	a	--		
.31	936,270	.4	p[c]	--		
.33	372,445	8.1	a	--		
.34	159,927	1.1	a	--		
.41	1,097,272	1.3	a	--		
.42	546,290	13.7	a	--		
.45	320,289	8.1	a	--		
.51	468,896	.3	a	--		
.52	1,185,702	.3	a	--		
.53	359,970	.1	a	--		
.54	227,115	.5	a	--		
.55	310,349	.5	a	--		
.57	595,797	4.6	a	--		

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[a] Data taken from Chapter 10. The weights do not include individual occurrences of less than .01 g. The volume excavated includes Stratum II for some concentrations. The sites for which floral and faunal remains are not yet sorted and tabulated are: 19BN323, 390, 410, 471, and 481.

[b] p = presence / a = absence

[c] 2 corn kernels and cob fragments

Frequency	Weights of Faunal Remains (in grams)	Scores
12	1.0	0, 1, 3, 3, 3, 4, 4, 4, 4, 5, 5, 9
14	1- 9	1, 1, 1, 2, 2, 2, 3, 3, 4, 4, 5, 6, 8, 8
3	10- 19	14, 14, 15
1	20- 29	26
1	30- 39	33
1	40- 49	41
	50- 99	
1	100-199	103
3	200-299	219, 257, 268
	300-399	
	400-499	
3	500	512, 662, 665
39		

FIGURE 16.2: Stem-and-Leaf Display of Total Faunal Remains (N=39 concentrations; weights rounded to nearest gram)

It is notable that seven of the nine concentrations containing subplowzone features, samples of which were floated, are also the concentrations with total faunal remains of more than 100 g. Most of the subplowzone features that were identified during the fieldwork seemed to be deeper levels of midden deposits the upper parts of which were disturbed by plowing during the historic period. This initial field interpretation of most features was confirmed by examination during laboratory analysis of plan and profile drawings that depicted their highly variable outlines, quite unlike the expected plans and profiles of postholes, pits or hearths. The correspondence noted here between the contents of general excavation levels in the plowzone and subplowzone features is another confirmation of the initial interpretation that most of the features are deeper sections of middens, the upper parts of which have been disturbed by historic plowing.

Like the prehistoric ceramics, the faunal and floral data are used in the later section of this chapter to help identify the prehistoric activities represented by the contents of each concentration. The presence of remains of bird, fish, mammal, carbonized seeds and carbonized nuts in the archeological deposits was interpreted as evidence that these resources were exploited for subsistence. Unfortunately, the apparent absence of these remains in other concentrations is not conclusive evidence that similar kinds of subsistence activities were not carried out at them. This is due to the incomplete data analysis and the pervasive disturbance of deposits by historic period plowing. Yet, the persistence of floral and faunal remains in the face of natural decomposition processes and human disturbances at the concentrations listed on Table 16.5, and those at 19BN323 and 390 where the remains are not yet tabulated, indicate that these concentrations were the loci, or very close to the loci, of various food preparation activities. Variation in the weights of different kinds of faunal remains was used as a rough indication of the intensity of exploitation of different kinds of food resources. The weights of remains are not accurate estimators of the absolute importance of individual food resources. Nor are they reliable for the comparison of the relative contribution of different resources to diet. Yet, rough comparisons can be made legitimately among the concentrations of the contribution of different faunal remains to the total faunal assemblage using relative frequencies. Variation in the relative frequencies of different remains among the concentrations might indicate variation in the frequency or intensity with which different resources were exploited. Comparison of the flotation results, for example, indicates that concentrations 308.71 and 341.24 have substantially more fish remains, 66% and 74% by weight respectively, than the other concentrations (Table 16.5). Activities that included the preparation of fish for consumption or storage probably occurred in or near these two concentrations.

The faunal and floral data available for comparisons are

TABLE16.5: Concentrations with More than 100 g of Faunal Remains, Floral Remains or Flotation Data (all weights in grams)[a]

	Excavation									Flotation								
Concentration	Volume Excavated (cubic cm)	Bird	Fish	Mammal	Other	Unidentified	Total Faunal	Carbonized Seeds	Carbonized Nuts	Volume Floated (cubic cm)	Bird	Fish	Mammal	Other	Unidentified	Total Faunal	Carbonized Seeds	Carbonized Nuts
308.21	871,049	.1	2.2	24.2	2.6	3.4	32.5	-	-	31,900	-	.2	-	1.7	2.2	4.1	tr[b]	-
		.3%	7%	74%	8%	10%	99.3%[d]				-	5%	-	41%	54%	100%		
308.33	2,790,173	33.+	66.0	389.3	61.8	111.0	661.8	-	-	40,000	.1	6.2	30.3	5.4	14.5	56.3	.4	tr
		6%	10%	59%	9%	17%	101%				.2%	11%	54%	10%	25%	100.2%		
308.42	3,399,964	16.4	5.0	246.9	147.0	46.8	512.1		.07	138,600	1.1	.5	6.4	.9	33.6	42.5	.01	
		3%	.9%	60%	29%	9%	101.9%				3%	1%	15%	2%	79%	100%		
308.71	327,623	9.3	15.8	87.2	135.4	8.8	256.5	-	-	45,738	.8	53.8	2.4	18.6	6.2	81.8	.47	tr
		4%	6%	34%	53%	3%	100%				1%	66%	3%	23%	8%	101%		
274.12	5,883,884	3.9	.3	86.3	-	12.1	102.6	-	-	17,495	.7	1.3	-	-	2.2	4.2	.05	tr
		4%	.1%	84%	-	12%	100.1%				17%	31%	-	-	52%	100%		
341.21	2,227,116	39.0	53.6	512.4	12.9	47.9	665.8	-	.35	6,066	.2	.6	5.0	-	2.6	8.4	.09	.44
		6%	8%	77%	2%	7%	100%				2%	7%	60%		31%	100%		
341.23	2,388,087	7.7	4.5	185.1	6.7	15.0	219.0	-	-	3,091	-	.7	4.1	-	3.3	8.1	.02	-
		4%	2%	85%	3%	7%	101%				-	9%	51%	-	41%	101%		
341.24	4,761,709	10.2	23.0	163.0	14.7	56.7	267.6	-	2.84	33,390	2.4	132.9	28.5	2.4	12.7	178.9	.7	.06
		4%	9%	61%	5%	21%	100%				1%	74%	16%	1%	7%	99%		
288.11	1,289,567	-	-	-	-	tr	-	-	-	3,568	-	tr	-	-	tr	tr	.02	-
288.31	936,270	-	-	--	-	.4	.4	.6[c]	-	-								

[a] The weights do not include individual occurrences of less than .01 g. Volumes excavated include Stratum II.

[b] tr = trace, <.01

[c] 2 corn kernels and cob fragments

[d] Total percentages that differ from 100 are due to rounding.

used in the later sections of this chapter to identify the types and ranges of predominant activities associated with concentrations.

Shellfish Remains and Fire-cracked Rock

The distributions and densities of these remains already have been used to delimit the concentrations and to identify variation in the types of archeological deposits. Variation in the amounts of shellfish and fcr among concentrations also reflects the extent to which shellfish processing, trash and garbage dumping and/or cooking occurred in or near a concentration.

Concentrations with high density scores for shell, fcr or both are listed in Table 16.6. These data are used in the subsequent sections with the other data already described to identify the prehistoric activities represented in a sample of the concentrations. Before proceeding, however, the chronological information that is available for concentrations will be reviewed. Since variation over time is an important aspect of this analysis, concentrations that can be dated will recieve the most attention in subsequent sections.

Chronological Information

The imprecision of the chronological information available for most of the concentrations limits the descriptions of adaptations to rather long temporal periods. The lack of temporal precision is unfortunate because it can encourage a normative view of the way of life during any given prehistoric period when there may in fact have been a wide range of behaviors that were parts of the adaptive state (Cordell and Plog 1979). Because the focus of a normative view is upon general patterns, important variation at the fringes or anomalies that are key to understanding particular cultural adaptations and change may be ignored (Gould 1980:29-47).

Although descriptions of prehistoric adaptations in the Northeast have tended to be rather normative, the flurry of recent investigations are revealing more diversity (McManamon 1983). Sanger (1982) and Spiess, et al. (1983), for example, recently have suggested that a wide range of prehistoric behavior occurred regarding the season of occupation and use of coastal environments in Maine.

Since one of the important goals of this analysis is to describe the variation in adaptations during different time periods and the changes that occurred or similarities that persisted over time, chronological information is essential. The Northeast is not an area renowned among archeologists for the

TABLE 16.6: Concentrations with Large Amounts of Shell Remains and Fire-cracked Rock
(N=72 concentrations; values are sums for grams/qcm)

Concentration	Total Shell	Fcr
308.26	* 8,153	* 6,489
.33	*118,979	*11,727
.42	* 32,969	* 5,447
274.12	* 1,794	* 8,937
.31	* 8,348	* 6,355
341.21	* 24,604	* 1,580
288.22	* 7,819	* 1,588
.32	* 2,133	* 2,170
.45	* 59,389	* 1,941
.53	* 12,592	* 1,812
.55	* 50,111	* 1,941
390.33	* 8,603	* 1,812
.34	* 4,185	* 3,820
336.14	* 2,068	* 3,211
169.22	* 2,277	* 1,803
308.11	* 87,862	742
.12	* 18,226	--
.14	*124,832	--
.15	* 5,641	314
.21	* 14,033	681
.22	* 15,837	--
.32	* 10,769	--
.34	* 1,787	587
.35	* 3,646	--
.71	*194,350	1,048
323.22	* 7,771	535
.23	* 1,752	974
273.11	* 2,778	8
341.23	* 3,434	1,334
288.11	* 12,054	679
.23	* 41,176	--
.31	* 48,069	779
.33	* 94,321	54
.42	* 20,169	115
.43	* 26,338	--
288.51	* 28,456	718
.52	* 20,474	928
.54	* 6,563	--
.56	* 10,180	141
.57	* 40,796	--
.58	* 5,467	--
336.11	* 7,647	686
337.11	* 16,008	--
308.51	541	* 7,148
.52	91	* 1,582
323.12	537	* 5,686
273.31	1,362	*19,789
274.22	110	*11,218
341.24	1,025	* 5,132
390.11	67	* 3,279
.21	144	* 2,722
.22	209	*14,648
.23	179	* 1,826
.31	250	* 6,270
.36	59	* 1,975
.37	130	* 3,168
356.21	0	* 1,864
282.23	4	* 4,232
.24	1	* 1,497
281.13	0	* 5,664
.14	0	* 2,235
.25	0	* 2,893
.26	8	* 1,762
.31	0	* 1,612
.33	637	* 4,409
.41	0	* 7,588
.42	0	* 8,763
.43	0	*10,988
.44	0	* 6,495
.45	22	*25,589
.46	4	*12,351
.47	4	*19,283

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* = High score, greater than 75th percentile. For grams of shell/qcm = 1,649 g/qcm, for grams of fcr/qcm = 1,415 g/qcm.

detail and precision of its chronological information, and the outer Cape is no exception. Although the study area has had a substantial amount of well-reported attention from avocational archeologists (see Moffett 1957), no C-14 dates existed prior to the ones obtained for the survey and only rough stratigraphic relationships were described by Moffett (1957).

Four techniques were used to attempt to date individual concentrations: C-14, projectile point typology, ceramic characteristics and the relative frequencies of two lithic raw materials (see Chapters 8 and 14).

Concentrations Dated by C-14

The C-14 technique was the most desirable and served to date, usually in conjunction with one or more of the other sources of chronological information, eleven concentrations (Table 16.7). The following descriptions of the dates, their contexts and implications for dating concentrations are summarized from descriptions in Chapter 8.

19BN308.00: This unusual designation refers to an area outside the boundaries of any concentration. In this case it is an area located just southeast of Concentration 308.33 near the edge of the Nauset marsh. The location is periodically inundated by tides. The sample that was dated comes from what appears to be an inundated, but intact, shell layer. The marine shell used for the C-14 test was taken from a level that included one lithic flake and some bone fragments. The profile of the augerhole indicates that the cultural level (52-66 cm below surface) was *in situ* rather than redeposited sediments. The date of 3925 ± 180 BP for the marine shell is the oldest date of any for the survey. It supports the consensus that shellfish were exploited by Late Archaic populations (Salwen 1965; Snow 1980:178-182), but at this point does not improve our understanding of the extent or scheduling of the Late Archaic exploitation of shellfish resources.

308.33: Concentration 308.33 has two C-14 dates, each from a different archeological level of a subplowzone general midden in Excavation Unit 300. The later date of 910 ± 145 BP came from a sample in the top level of the midden. Levels immediately below this one contained three fragmentary Levanna points; their close association is consistent with the Late Woodland C-14 date. The plowzone levels above the intact midden, which are the materials analyzed in this study, were assigned to the Late Woodland period based upon this stratigraphic relationship.

The other date from Excavation Unit 300 is from a sample from the bottom level of the midden. The date of 3350 ± 170 BP associates the beginning of the midden with the Late Archaic period. It is later than the nearby inundated cultural shell

TABLE 16.7: Summary of C-14 Dates[a]

Conc.	Date	Provenience[b]	Lab #	Material and Weight
308.00	3925 ± 180 BP	802-00-052	GX-9703	marine shell, 72.3 g
308.33	900 ± 145 BP	300-00-052	GX-9701	marine shell,100.4 g
.33	3350 ± 170 BP	300-00-094	GX-9702	marine shell,111.6 g
308.42	3260 ± 135 BP	107-06-061	GX-9700	marine shell,153.8 g
308.51	1075 ± 180 BP	202-00-030	GX-9704	marine shell,153.8 g
323.22	180 ± 115 BP	20-01-040-045	GX-9553	wood charcoal, 3.9 g
.22	590 ± 110 BP	20-01-045	GX-9554	marine shell,106.1 g
274.12	1265 ± 130 BP	23-01-027	GX-0550	wood charcoal, 5.7 g
.12	1570 ± 120 BP	23-01-027	GX-9551	marine shell,101.1 g
.12	1285 ± 120 BP	22-00-020	GX-9552	marine shell,103.7 g
341.21	1000 ± 145 BP	23-00-030	GX-9561	marine shell,101.3 g
.21	1375 ± 155 BP	23-00-030	GX-9562	marine shell,104.3 g
341.23	1075 ± 110 BP	13-03-031	GX-9556	marine shell, 44.0 g
.23	1110 ± 150 BP	13-04-031	GX-9557	marine shell, 20.2 g
341.24	970 ± 120 BP	12-01-035	GX-9555	marine shell, 62.5 g
.24	890 ± 150 BP	15-01-036-056	GX-9558	wood charcoal, 3.4 g
.24	1090 ± 155 BP	15-01-036	GX-9559	marine shell, 75.6 g
.24	1460 ± 155 BP	21-02-038	GX-9560	marine shell, 59.7 g
390.33	1600 ± 130 BP	9-01-081	GX-9705	wood charcoal, 8.1 g
.33	3315 ± 145 BP	9-03-107	GX-9706	wood charcoal, 5.3 g
410	370 ± 120 BP	3-01-009	GX-9707	wood charcoal, 3.1 g

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[a]Data summarized from Chapter 8

[b]Provenience code: test unit number-feature number-level number(s)

layer (308.00), but its range overlaps with the C-14 date from Concentration 308.42.

308.42: One sample from Concentration 308.42 was dated. Like the Late Archaic sample from 308.33, this one came from the lowest level of a midden. The midden was composed of a series of shell lenses that seemed to represent single depositional events. The level from which the sample was taken rested in a submidden soil depression. As in Excavation Unit 300, this midden seems to have begun forming during the Late Archaic. The plowzone and stratigraphically higher midden levels of this concentration, however, were assigned to the Woodland period for this study because they contained mainly Late Woodland pottery sherds.

308.51: One sample from Concentration 308.51 was dated. The sample was taken from the lowest level of the plowzone in Exacavation Unit 202. High densities of lithics, shell and fcr from this level suggested that the context had not been too badly disturbed by plowing. Three quartz Squibnocket triangular projectile points were found in the same level, as were 26 shell-tempered sherds (16.1 g). The sample was chosen for dating to check whether the shell remains were associated with the Late Archaic Squibnocket points. The sample date of 1075 ± 180 BP clearly dates the shell to the Late Woodland period and probably is associated also with the shell-tempered pottery.

The Squibnocket points and high relative frequency of quartz (11.8% of 1125 lithics) for 308.51 suggest that both Late Archaic and Late Woodland component are associated with 308.51. Based upon the C-14 date, the midden deposit seems to date from the Late Woodland period alone.

323.22: Two samples were dated from Concentration 323.22. Both dates were from Feature 01 in Excavation Unit 20, a large, partially plow-disturbed shell lens. The samples were taken from the unplowed portion of the feature. The shell sample date of 590 ± 110 BP is consistent with the shell-tempered, cord-marked pottery and Levanna points in the feature and in plowzone levels above and adjacent to the feature.

The other date of 180 ± 115 BP was on a sample that combined charcoal pieces recovered by flotation of the feature fill. The date is not consistent with the contents or structure of the feature or the larger concentration assemblage. It probably reflects contamination by historic period charcoal, but the mechanism by which this occurred is unknown.

274.12: Two samples were dated from Feature 01 in Excavation Units 16 and 23. The upper portion of the feature had been plow-disturbed. The samples, one of shell, the other of wood charcoal, were taken from the undisturbed portion. No diagnostic artifacts, save a tiny shell-tempered sherd, were found in the feature, although it also contained nine quartz lithics and two jasper (i.e., an exotic lithic) trim flakes. The entire

concentration assemblage, which was mainly from plowzone levels, included three Levanna, eight Jack's Reef corner-notched, and three Squibnocket triangular points. Childs (see Chapter 14) has identified five vessel lots for the concentration most of which display Middle Woodland period attributes (e.g., incising, scallop shell and punctation decorative techniques and some triangular decorative motifs). The Middle Woodland pottery is consistent with the Jack's Reef points. The two dates of 1265 ± 130 BP and 1570 ± 120 BP are consistent with a Middle Woodland period occupation. The relationship of the Late Archaic and Late Woodland points is uncertain except to note that these two components also occur in the concentration, but are less prominent than the Middle Woodland component.

The lack of close overlap between these two dates from the same concentration is puzzling. The feature does not appear to have been formed by different depositional events. A similar discrepancy between a pair of shell and wood charcoal dates was found in Concentration 341.24. It may be that these marine shell dates are systematically shifted a few hundred years older than their true age, or that the wood charcoal samples have been affected in the opposite way. Similar systematic shifts in C-14 dates on marine shell have been noted by others in New England and elsewhere (Maugerud 1972; Sanger, personal communication 1984). The shifts seem to be locally consistent, although no general pattern has been recognized. The exact reason for the discrepancies among these specific dates is not known, but the effect is most likely natural and the samples were interpreted for this study as contemporaneous.

Another sample from the bottom level of the plowzone in Excavation Unit 22 also was dated. Four Jack's Reef points and one possible Meadowood blade were found in this level, as well as many sherds from a shell-tempered vessel with dentate and incised decorations. 8.6% of the 176 lithics in this level were jasper. The date of 1285 ± 120 BP is consistent with the Middle Woodland artifact assemblage in the level and the concentration as a whole.

341.21: Two samples from a 1-5 cm thick midden just below the plowzone were dated. Plowing seems to have disturbed the portion of the original midden that once extended above the remaining portion. One Levanna point and another triangular biface that might be an unfinished Levanna were found in the dated level along with both shell- and grit-tempered sherds. The plowzone levels of Concentration 341.21 contained another four Levanna points, but also four Squibnocket triangle points. One of the C-14 dates, 1375 ± 155 BP, suggests that the midden deposit began to accumulate during the Middle Woodland. The other, 1000 ± 145 BP, seems to be associated with a Late Woodland component that includes the Levanna points. This indicates that the midden was added to during this period also. The mixture of temper types among the pottery sherds and vessel lots represented suggests occupation during both these parts of the Woodland period. The

Squibnocket points indicate that some level of activity occurred in this area during the Late Archaic, but it seems not to have involved any midden deposits.

341.23: Two samples were dated. Both were from shallow, small pockets of midden that seemed to extend down from the plowzone into the subsoil. It seems likely that they are portions of the basal layer of a midden that once existed in this area but has been disturbed by plowing. Plowzone levels of Excavation Unit 13 and its neighbor Unit 18 contain a mixture of Late Archaic, Early and Late Woodland diagnostics including 1 Squibnocket stemmed point, 2 Susquehanna Broad/Wayland Notched points, 1 possible Lagoon point and 5 Levannas; 3 shell-tempered vessel lots, 1 grit-tempered lot and 1 mixed-temper lot. The dates of 1075 ± 110 BP and 1110 ± 150 BP indicate a Late Woodland beginning for the midden deposit. As with Concentration 341.21, earlier activities seem to have occurred, but they seem not to have resulted in midden deposits.

341.24: Four samples from three subplowzone features were dated. The high densities of lithics, shell and fcr in the plowzone levels above these features suggest that they are parts of a basal layer of a former midden now mainly plow-disturbed. The dates range from 890 ± 150 BP to 1460 ± 155 BP. Three are related to the Late Woodland period, and the oldest to the Middle Woodland period. A pair of dates, one for wood charcoal and the other for marine shell, both from Feature 01 in Excavation Unit 15, exhibit the same variation noted for a similar pair of dates froma single feature in Concentration 274.12. No obvious explanation presents itself to explain the 341.24 variation either. The diagnostic artifacts in the plowzone levels of excavation units with dated deposits and other nearby units are mixed, but the bulk of them are associated with the Late Woodland: 1 Levanna point in the Feature 01 level directly below the C-14 sample taken from that feature (970 ± 120 BP), 13 other fragmentary and whole Levannas, 3 Squibnocket triangles, 2 grit-, 2 mixed-, and 8 shell-tempered vessels.

The midden deposits in this concentration seem to have begun to accumulate during the Middle Woodland, but probably were used most in the Late Woodland. The small number of Squibnocket points indicates some Late Archaic activity, but not of the intensity, nature or duration of the later occupations.

390.33: Two samples from two different subplowzone features in Excavation Unit 9 were dated. Feature 01 was a large, irregularly shaped lens of unburned shell that began immediately beneath the plowzone. Sherds of two vessel lots, one mixed-tempered undecorated and the other grit-tempered punctate, were recovered from the feature. These sherds are consistent with the Middle Woodland date of the feature sample, 1600 ± 130 BP.

The second sample was taken from Feature 03, also in

Excavation Unit 9. The feature began about 107 cm below the surface and extended to about 115 cm. Its has been described as a hearth because it was filled with a large amount (6800 g) of fcr and little else. It is stratigraphically distinct from Feature 01 which overlies it. No artifacts were associated with it directly, but the concentration includes diagnostic artifacts that are consistent with the Late Archaic date of 3315 ± 145 BP (1 Susquehanna Broad and another biface with Susquehanna technological attributes and 1 Squibnocket stemmed). Another diagnostic point, a Rossville, is consistent with the date for Feature 01.

19BN410: No concentrations have been delimited yet for this site, but a sample from a thin oyster midden in the site was dated. The date of 370 ± 120 BP is consistent with diagnostic points, three Levannas found in the site area.

Concentrations Dated by Diagnostic Lithics and Ceramics

Projectile point and/or ceramic typologies are the most frequently used techniques for dating sites or components in the Northeast and they were relied upon heavily in this study (see Chapter 8). The associations of point types with a particular temporal period (Table 16.8) were based upon standard works (e.g., Dincauze 1968, 1971, 1974, 1975, 1976; Ritchie 1969, 1971) as well as the typology developed from these sources and used by the Massachusetts Historical Commission (1980) for its statewide inventory of prehistoric archeological collections. Ceramic typology in New England is in its infancy (Childs 1982; Luedtke 1983; Petersen and Powers 1983); however, for analysis of the survey pottery, Childs developed a method that used technological, decorative and design attributes to assign vessel lots to time periods (see Chapters 13 and 14). In her analysis Childs utilized standard sources such as Dincauze (1974, 1975) and Ritchie (1969), sources on local ceramics (e.g., Moffett 1957), and contemporary work (e.g., Luedtke 1983; Petersen and Powers 1983).

The frequency of two types of lithic raw materials in prehistoric assemblages may indicate a particular chronological association for the assemblage. It is acknowledged widely that Squibnocket complex or Small Stemmed tradition components, many of which are associated with absolute dates for the Late Archaic period, have lithic assemblages that are predominately quartz. One of the largest sites discovered and examined by the survey, 19BN281, seems to be a relatively undisturbed single component Small Stemmed tradition site. There are, unfortunately, no C-14 dates from this site, but the associated projectile points are all of this tradition and the total site lithic assemblage is over 90% quartz.

There is a similar, though less dramatic, association of chert with sites dated absolutely to the Early, or especially the

TABLE 16.8 Periods and Projectile Point Types[a]

Period/Tradition	Type	Reference
Late Archaic		
Laurentian tradition		
	Otter Creek	Ritchie 1971: 40-41
	Brewerton side-notched	Ritchie 1971: 19-20
Small Stemmed tradition		
	Poplar Island	Ritchie 1971: 44-45
	Bare Island	Ritchie 1971: 14-15
	Wading River	Ritchie 1971: 131-132
	Squibnocket stemmed	Ritchie 1971: 126
	Squibnocket triangle	Ritchie 1971: 127-128; Massachusetts Historical Commission 1980
Broadspear tradition		
	Snook Kill/Atlantic	Ritchie 1971: 47-48; Dincauze 1972
	Susquehanna broad/ Wayland notched	Ritchie 1971: 53-54 Dincauze 1968: 23-26
	Orient	Ritchie 1971: 39
Early Woodland		
	Meadowood	Ritchie 1971: 35-36
	Lagoon	Ritchie 1971: 122
Middle Woodland		
	Rossville	Ritchie 1971: 46
	Fox Creek	Ritchie 1971: 50-52; Funk 1976: 287-288
	Greene	Ritchie 1971: 122; Funk 1976: 83, 294-295
	Jack's Reef	Ritchie 1971: 26-28
Late Woodland		
	Levanna	Ritchie 1971: 31-32; Massachusetts Historical Commission (1980)

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[a]Modified from Chapter 8, Figure 8.3

Middle Woodland periods (Barber 1982a; Feder 1981a; Luedtke 1975). Concentration 274.12 in the Nauset Marsh area of the survey provides the most substantial example of this association within the study area.

These general patterns of lithic raw material associations led Borstel (see Chapters 8 and 15) to examine the relative frequency distributions of chert and quartz among all 176 concentrations of the data set. He found a break in the distribution of quartz percentages at about 10% and in those for chert at about 1%. These values have been used in the chronological interpretations to indicate the possible presence of Late Archaic or Middle Woodland components.

This last technique should be interpreted carefully by readers, especially the use of chert relative frequencies. The frequencies of chert are never very high and in small assemblages a single piece of it would equal or even exceed 1%. Although the quartz score is higher, at 10% it is far from the 90% or greater observed in the 19BN281 concentrations.

The following brief descriptions of components associated with concentrations are summaries of analyses done by Borstel (see Chapters 8 and 15) and Childs (see Chapters 13 and 14).

19BN308: The prevalence of cordmarked, shell-tempered ceramic vessel lots associated with Concentrations 308.11, .14, .21, .22, .31, .33 and .34 implies Late Woodland components at each of these concentrations, as does a Levanna point in 308.24. Concentrations 308.14 and .33 each had a Middle Woodland Fox Creek point in their assemblages, but each concentration also had more Late Woodland points (2 Levannas at 308.14 and 3 at 308.33). Concentration 308.33 also had a C-14 date of 910 ± 145 BP for a midden level at the base of the plowzone. This strongly suggests that the assemblages considered from 308.33 for this analysis are Late Woodland.

Decorative techniques (incising, dentate impressions, scallop impressions and combing) used on vessel lots from plowzone levels in Concentrations 308.41, .42, and .43 suggest Middle Woodland occupations that also extended into the Late Woodland. Two Levanna points in Concentration 308.42 indicate a Late Woodland component along with the Middle Woodland one suggested by the pottery. Also for 308.42, at least the basal level of the subplowzone midden deposit is Late Archaic based upon a C-14 date. The relatively high percentage of chert in Concentration .42 (1.2% of 691 lithics) supports the Middle Woodland pottery designation.

Concentration 308.43 seems mainly Middle Woodland with chert lithics as 7.9% of 267, and a Jack's Reef point in the assemblage. Concentration 308.51 contained one cordmarked shell-tempered vessel lot that indicates a Middle-to-Late Woodland component. A C-14 date on shell from the bottom of the

plowzone emphasizes a Late Woodland component. In addition some Late Archaic activity occurred there since five Squibnocket triangles were found.

The pottery in Concentrations 308.71 and .72 seems to be mainly Middle-to-Late Woodland.

19BN323: For Concentrations 323.22, .23 and .24 pottery and points indicate mainly Late Woodland occupations. For 323.22 a C-14 date supports a Late Woodland designation. Concentration .21 contained projectile points associated with the Late Archaic (Susquehanna Broad) and Middle Woodland (Rossville), as well as 2 Levannas.

19BN274/339: Concentration 274.22 seems to be a Late Archaic component. It contained one Poplar Island point and had a high percentage of quartz artifacts (50% of 212 artifacts). Concentrations 274.11 and .13 seem to be mainly Late Archaic components. Both contained one Squibnocket Triangle point, and the 274.13 lithic assemblage is 18.8% quartz (total artifacts = 133).

Concentration 274.12 includes a substantial Middle Woodland component that was dated by three C-14 samples (Table 16.7). Its assemblage includes a relatively high percentage of exotic lithics (4.3% out of 1917). The decorative techniques used on the pottery are the same ones used on known Middle Woodland components, including strata 2 and 3 at the Cunningham site on Martha's Vineyard (Ritchie 1969). Eight Jack's Reef points, all but one of an exotic lithic material, also argue for a Middle Woodland designation. The concentration also includes Late Archaic (4 Squibnocket triangles) and Late Woodland (3 Levanna points) components, but the Middle Woodland component predominates. There seem to have been some Late Archaic and Late Woodland activities in the area as well as the Middle Woodland occupation. The Middle Woodland occupation seems to have been the most intensive or extended one, judging from the diagnostic points and pottery and the C-14 dates.

19BN273/275: Concentration 273.11 contained a Small Stemmed point, which suggests at least a Late Archaic component. It contained only 32 artifacts, however, and covers a relatively large area. Due to the small assemblage size and diffuse artifact distribution, the assignment of this concentration to a specific prehistoric period is problematic. For these reasons it was not considered further in this analysis.

19BN341: The Late Woodland period is prominently represented in the concentrations at this site. This is true of the lithic and pottery diagnostics, as well as the C-14 dates. Concentration 341.22 was dated to the Late Woodland by the presence of one Levanna point; other components may be present, but if so, there are no diagnostic traces of them.

Three other concentrations, 341.21, .23 and .24, had C-14 dates that associate with the Late Woodland the basal levels of middens that were found in each one. One date for 341.21 (1375 ± 155 BP) suggests that the midden there began to form even earlier, during the Middle Woodland, and continued to build up into the Late Woodland. Some of the pottery in 341.23 and .24 (e.g., grit-tempered, dentate-decorated) indicate that some use of the entire area might have occurred during the Middle Woodland.

Each of these concentrations also contained points that are diagnostic for earlier periods, mainly the Late Archaic. The middens seem firmly dated to the Middle or Late Woodland. Therefore, the Late Archaic activities in this area seem not to have been as intensive or as long-lived as those of later time periods.

19BN288: The concentrations at 19BN288 contained fewer diagnostic points and pottery vessel lots per capita than many of the concentrations discussed so far. In addition, no C-14 dates are available for the concentrations at the site. Late Woodland components are indicated by diagnostic pottery, points or both for Concentrations 288.22, .31, .42, .45, .52 and .53. A localized distribution of grit-tempered sherds, some with faint evidence of cordmarking, and one possible Vinette 1 vessel might represent Early or Middle Woodland activities in Concentration 288.54.

Small stemmed tradition points in Concentrations 288.21, .32 and .52 indicate some Late Archaic activities there. Relatively high percentages of quartz also suggest possible Late Archaic components in Concentrations 288.41 (13.4% of 119 lithics), .42 (10.4% of 228 lithics), .51 (10.2% of 245 lithics) and .63 (16.4% of 116 lithics).

19BN390: As a whole this site reflects occupation and use during the Late Woodland least of all the sites considered so far. Only one out of the eight diagnostic points found was a Levanna, and the diagnostic pottery mainly has Middle Woodland decorative and technological characteristics. Concentration 390.22 contained a possible Lagoon point, and had a relatively high percentage of quartz, but contained fewer than 100 artifacts and covered a wide spatial area so it was considered no further here.

Concentration 390.33 contained a variety of Late Archaic diagnostic points as well as a Rossville point and a Levanna point. Concentration 390.33 also contained a variety of grit- and shell-tempered sherds that were decorated with rocker dentate, scallop impresions and cord-wrapped stick which suggest mainly a Middle Woodland occupation. The existence of both Late Archaic and Middle Woodland components is supported by C-14 dates (3315 ± 145 BP and 1600 ± 130 BP, respectively).

Relatively high quartz percentages suggest Late Archaic

activities at several concentrations: 390.31 (10.8% of 102), .33 (21.2% of 306), .35 (10.3% of 107) and .36 (12% of 99). Concentration 390.36 also contained one diagnostic Late Archaic point (Bare Island).

19BN336: Concentration 336.11 contained three diagnostic points, one Late Archaic (Squibnocket triangle), one Middle Woodland (Fox Creek lanceolate) and one Levanna indicating the periods of activities there. It also contained shell-tempered pottery typically associated with the Late Woodland. Concentration 336.14 also contained shell-tempered pottery, but no specific diagnostic pottery or points. A relatively high percentage of quartz (11.4% of 719 lithics) suggests a Late Archaic component. Neither of these concentrations has any strong evidence for a predominance of activities during a single period.

19BN374: The pottery and most diagnostic points contained in these concentrations were Late Woodland. Quartz percentages are low. A few concentrations included diagnostic points associated with other time periods, but the overall pattern among the concentrations suggests that these do not reflect substantial earlier components.

19BN355/356: All of the concentrations in this site have percentages of quartz at or above about 75%, suggesting that all the concentrations are Late Archaic single components. Concentration 355.12 contained one Squibnocket stemmed point which supports this interpretation; no other diagnostic points and no pottery were found in the site. Only Concentrations 355.12 and 356.21 were included in this study. The assemblage sizes of the other concentrations were too small for analysis.

19BN282/283/284: Among the concentrations with more than 100 artifacts in their assemblages at this site, the precentage of quartz ranges from 13.3% of 850 lithics (282.23) to 48.6% of 146 lithics (282.12). The concentrations seem mainly to represent Late Archaic Squibnocket complex components. A single Jack's Reef point in Concentration 282.41 suggests that a Middle Woodland component also exists for that concentration.

19BN281: The overall percentage of quartz artifacts for this site is 93.4%. All seven of the diagnostic points found in concentrations (1 Squibnocket triangle, 281.24; 2 Bare Island points, 281.44 and .46; 3 Squibnocket stemmed, 281.41, .43 and .46; and 1 other small stemmed, 281.46) fit within the Late Archaic small stemmed tradition.

Summary of Chronological Information

Eighty-three concentrations that contained some type of data that could be used for dating were reviewed. The inclusion of C-14 dates from 308.00 and 19BN410 made this group slightly

TABLE 16.9: Time Periods Represented at Concentrations

Concentration	Primary Components	Secondary Components	Comments
308.00	LA	--	LA C-14 date on shell from auger test of inundated midden
.11	LW	--	--
.14	LW	MW	--
.21	LW	--	--
.22	LW	--	--
.24	LW	--	--
.31	LW	--	--
.33	LW	LA, MW	LA is C-14 date at base of midden
.34	LW	--	--
.41	MW	--	--
.42	MW, LW	LA	LA is C-14 date at base of midden
.43	MW	--	--
.51	LW	LA	LW C-14 date on shell at base of plowzone
.71	MW-LW	--	Middle-to-Late Woodland
323.21	LW	LA, MW	--
.22	LW	--	--
.23	LW	--	--
.24	LW	--	--
274.11	LA	--	--
.12	MW	LA, LW	1 MW C-14 date on shell at base of plowzone; 2 MW C-14 dates from feature
.22	LA	--	--
341.21	MW-LW	LA	MW and LW C-14 dates on shell at base of midden
.22	LW	--	--
.23	LW	LA, MW	LW C-14 dates on shell at base of midden
.24	LW	LA, MW	LW C-14 dates on shell and charcoal at base of midden
288.21	LA	--	a single Wading River point
.22	LW	--	--
.31	LW	--	--
.32	LA	--	--
.41	LA	--	based on % of quartz only
.42	LW	LA	based on % of quartz only
.45	LW	--	--
.51	LA	--	based on % of quartz only
.52	LW	LA	--
.53	LW	EW, MW	--
.54	EW-MW	--	based on a small amount of Vinette 1 pottery
.63	LA	--	based on % of quartz only
390.31	LA	--	based on % of quartz only
.33	MW	LA	both components C-14 dated
.34	LA	--	based on % of quartz only
.35	LA	--	based on % of quartz only
.36	LA	--	based on % of quartz only

TABLE 16.9 (continued)

Concentration	Primary Components	Secondary Components	Comments
336.11	--	LA,MW,LW	evidence is uniformly weak for each
.14	--	LA, LW	evidence is uniformly weak for each
374.11	MW	LA	LA is possible Atlantic tradition Boats blade
.21	LW	LA	LA is due to two Wayland Notched points
.43	LW	--	based on Levanna point
.44	LW	--	based on Levanna point
.45	LW	--	based on Levanna point
.46	LW	--	based on Levanna point
.51	LW	--	based on Levanna point
.54	LW	--	based on Levanna point
.62	--	LA	LA Squibnocket triangle probably not related to primary component
355.12	LA	--	--
356.21	LA	--	--
282.12	LA	--	--
.22	LA	--	--
.23	LA	--	--
.24	LA	--	--
.41	LA	MW	--
.42	LA	--	--
281.12	LA	--	--
.13	LA	--	--
.14	LA	--	--
.15	LA	--	--
.22	LA	--	--
.23	LA	--	--
.24	LA	--	--
.25	LA	--	--
.31	LA	--	--
.33	LA	--	--
.34	LA	--	--
.41	LA	--	--
.42	LA	--	--
.43	LA	--	--
.44	LA	--	--
.45	LA	--	--
.46	LA	--	--
.47	LA	--	--
.48	LA	--	--

Key
LA=Late Archiac
EW=Early Woodland
MW=Middle Woodland
LW=Late Woodland

larger than the 81 concentrations analyzed in Chapter 9. The chronological interpretations are summarized on Table 16.9. Two concentrations, 273.11 and 390.22, were not included on it because their small assemblage sizes and large areas made chronological interpretations too uncertain.

The next section analyzes the archeological deposits and infers past activities. This is followed by sections that present the data on seasonality and external cultural contact, along with interpretations of these aspects of the prehistoric cultural adaptations. Following these, another section of this chapter then discusses prehistoric economic activities and spatial organization as they reflect the cultural adaptations.

Deposits and Activities

In Chapter 9 the densities of lithics, shellfish remains, and fire-cracked rock, and the diversity of the lithic assemblage were used to characterize the archeological deposits in each concentration. It was argued that concentrations with dense remains and a high diversity of lithic artifact types contained secondary deposits, and concentrations without any dense remains, or with some but also with a low diversity of lithic artifact types, were primary deposits. Many concentrations with characteristics between these extremes also were identified. Chapter 9 included a technological description and analysis of all the assemblages that contained more than 100 artifacts. The results of both these analyses are combined here with the information summarized above about prehistoric ceramics, faunal and floral remains, shellfish and fcr to identify the prehistoric activities associated with the concentrations.

The activity analysis was done on 81 concentrations for which chronological information also was available, as summarized in the proceeding section. Datable concentrations were selected because the description and comparisons of human cultural adaptations at different times during prehistory is an important goal of this analysis. Data that can be assigned to specific temporal periods obviously are needed to identify temporal variation.

Of the 81 concentrations, 24 do not have any high density scores (Table 16.10), 20 have high scores for a single density variable (Table 16.11) and 37 have high scores for two or three density variables (Table 16.12). The deposit and activity types associated with individual concentrations are described and analyzed in the next section. In the following subsections the concentrations are considered in order from south to north and are grouped according to the area where they occur, for example, Fort Hill, southern side of Salt Pond, High Head, etc. This kind of arrangement facilitates the discovery of spatial variation in the types of deposits and activities within the study area.

TABLE16.10: Summary of Contents and Structure, Datable Concentrations without Dense Remains

	Concentration	Lithic Activities: Primary Manufacturing	Lithic Activities: Secondary Manufacturing	Lithic Activities: Tool Maintenance	Pottery (grams)[a]	Faunal Remains (grams)[a,b]	Floral Remains[b]	Shellfish Remains[a] (sum. g/qcm)	Fire-cracked Rock[a] (sum, g/qcm)	Number of Lithic Artifacts	Excavated Volume (cubic cm)	Number of Artifact Types
Fort Hill												
	308.24	*			-	a	a	1320	-	119	439,600	16
	.31	*			4	a	a	1471	-	18	391,330	11
	.41	*	*	*	2	2	a	307	8	260	2,325,328	19
	.43	*			13	14	a	17	-	267	1,130,000	20
	323.21	*	*	*	3	p	?	811	297	488	1,856,026	19
	.24		*	*	1	a	?	104	-	53	655,000	12
So. side, Salt Pond												
	274.11		*	*	-	a	a	1583	412	34	439,080	8
No. side, Salt Pond												
	288.21	*			4	a	a	923	-	75	1,668,355	17
	.41	*			6	1	a	1349	151	119	1,097,272	15
	.63		*	*	1	a	a	64	-	116	823,999	13
	390.35		*	*	3	a	a	60	104	107	1,111,110	15
Coast Guard Beach												
	374.11		*		-	a	a	-	-	517	2587,250	18
	.43		*		17	a	a	258	-	350	1,644,692	18
	.44	*	*		28	a	a	686	-	64	492,373	13
	.45		*		-	a	a	148	-	302	2074,692	18
	.46		*		13	a	a		-	466	2,584,726	22
	.51		*		-	a	a	-	-	201	2054,848	17
	.62	*			-	a	a	1530	-	31	283,858	10
High Head												
	355.12		*	*	-	a	a	8	200	269	439,416	11
	282.12	*	*	*	-	a	a	49	778	146	417,228	14
	.22		*		-	a	a	-	793	221	441,172	14
	.41		*	*	-	a	a	-	-	332	500,960	17
	.42	*			-	a	a	-	67	147	506,760	14
	281.24	*	*		-	a	a	-	868	86	211,948	9

[a] = value rounded to the nearest integer

[b] = p = present/ a = absent/ ? = sample not yet sorted

TABLE16.11: Summary of Contents and Structure, Datable Concentrations with Dense Deposits for One Type of Remains

Concentration	Lithic Activities: Primary Manufacturing	Lithic Activities: Secondary Manufacturing	Lithic Activities: Tool Manufacture	Pottery (grams)[a]	Faunal Remains (grams)[a,b]	Floral Remains[b]	Lithics (sum, number/qcm)[c]	Shellfish Remains (sum, g/qcm)[c]	Fire-cracked Rock (sum, g/qcm)[c]	Number of Lithic Artifacts	Excavated Volume (cubic cm)	Number of Artifact Types
Fort Hill												
308.22	*	*		4	3	a	792	* 15,837	- -	115	472,021	15
.71	*	*		162	257	p	642	*194,350	1,048	218	327,623	18
323.23		*		3	p	?	215	* 1,752	974	231	658,960	19
So. side Salt Pond												
273.11	*			-	a	a	260	* 2,778	8	32	351,880	12
274.22		*	*	-	a	a	258	110	*11,218	208	1,148,192	19
341.22	no high scores			1	1	a	*1,279	427	1,002	311	559,639	18
No. side Salt Pond												
288.42	*			25	14	a	360	* 20,169	115	228	546,290	17
.54		*	*	2	1	a	536	* 6,563	-	72	227,115	11
390.22		*	*	-	a	a	391	209	*14,648	88	969,025	16
.36		*	*	-	a	a	595	59	* 1,975	99	404,717	14
No. side, Nauset Marsh and Coast Guard Beach												
336.11		*	*	5	a	a	610	* 7,647	686	274	464,116	20
374.21	*	*	*	4	a	a	*1,326	160	277	1415	2,317,822	19
.54	*	*		1	a	a	* 858	124	-	711	1,208,231	23
High Head												
281.12		*	*	-	a	a	*4,941	-	49	508	162,440	7
.15		*	*	-	a	a	*1,076	-	1,251	164	100,400	7
.22	*	*	*	-	a	a	*1,050	23	269	137	83,256	9
.23		*	*	-	a	a	* 975	-	-	107	216,427	8
.25	*	*	*	-	a	a	522	-	* 2,893	106	156,688	7
.34		*	*	-	a	a	*1,790	-	1,225	177	195,340	11
.48		*	*	-	a	a	*1,960	21	1,152	313	263,095	14

[a] value rounded to the nearest integer

[b] P = present/a = absent/? = sample not yet sorted

[c] asterisk indicates high score, i.e., 75th percentile or larger, for lithics/qcm = 758, for g Shell/qcm = 1649 g, for g Fcr/qcm = 1415 g.

TABLE 16.12: Summary of Contents and Structure, Datable Concentrations with Dense Deposits for Two or Three Types of Remains

Concentrations	Primary Manufacturing	Secondary Manufacturing	Tool Maintenance	Pottery (grams)[a]	Faunal Remains (grams)[a,b]	Floral Remains (p/a)[b]	Lithics sum, number/qcm[c]	Shellfish Remains (sums, g/qcm)[c]	Fire-cracked Rock (sums/g/qcm)[c]	Number of Lithic Artifacts	Excavated Volume (cubic cm)	Number of Artifact Types
Fort Hill												
308.11	*	*	*	12	26	a	*3,747	* 87,862	742	2067	1,107,723	23
.14		*	*	15	15	a	*1,647	*124,832	-	1954	1,062,599	22
.21	*	*	*	50	33	p	* 943	* 14,033	681	167	871,049	18
.33	*	*	*	31	662	p	* 935	*118,979	*11,727	209	470,953	17
.34	*			4	2	a	*1,310	* 1,787	587	636	735,977	22
.42		*		162	512	p	608	* 18,782	* 5,447	691	3,399,964	20
.51	*	*	*	9	41	a	* 921	541	* 7,148	1125	1,143,144	23
323.22		*	*	144	?	?	*1,000	* 7,771	534	2569	4,087,744	22
So. side, Salt Pond												
274.12	*	*	*	802	103	p	757	* 1,794	* 8,937	2139	5,883,884	23
341.21	*	*		154	666	p	*5,240	*24,604	* 1,580	2718	2,119,116	23
.23	*	*	*	1384	219	p	*1,905	* 3,434	1,334	3128	1,322,110	22
.24	*	*	*	418	268	p	*2,719	1,025	* 5,132	4133	2,690,490	23
No. side, Salt Pond												
288.22			*	1	6	a	268	* 7,819	* 1,588	77	480,224	14
.31		*	*	24	1	p	*1,018	*48,069	778	524	898,689	21
.32	*	*	*	-	a	a	752	* 2,133	* 3,316	111	329,434	15
.45		*	*	4	8	a	*1,096	*59,389	* 1,550	155	320,289	12
.51	no high scores			6	1	a	*1,070	*28,456	718	245	468,896	17
.52	*	*	*	43	1	a	*1,282	*20,474	928	1063	1,185,702	21
.53	*	*	*	5	1	a	497	*12,592	* 2,170	131	359,970	14
390.31		*	*	1	a	a	* 928	250	* 6,270	102	403,656	12
.33		*	*	342	p	?	229	* 8,603	* 1,812	343	3,225,816	20
.34		*	*	17	p	?	306	* 4,185	* 3,820	111	757,308	14
No. side, Nauset Marsh												
336.14		*	*	2	-		687	* 2,068	* 3,211	631	1,204,200	18
High Head												
356.21	*						* 889	-	* 1,864	1465	1,412,500	19
282.23		*	*	-	-		* 926	4	* 4,232	850	1,420,500	19
.24		*	*	-	-		*1,443	1	* 1,497	1730	1,317,836	20
281.13		*	*	-	-		*5,335	-	* 5,664	539	179,876	8
.14		*	*	-	-		*2,400	-	* 2,235	314	201,455	15
.31		*	*	-	-		*1,209	-	* 1,612	149	261,145	9
.33		*	*	-	-		*5,946	637	* 4,409	504	302,002	11
.41		*	*	-	-		*8,266	-	* 7,589	1222	202,726	12
.42	*	*	*	-	-		*2,309	-	* 8,763	296	121,334	10
.43		*	*	-	-		*6,363	-	*10,988	708	115,520	17
.44		*	*	-	-		*2,943	-	* 6,495	363	124,402	12
.45		*	*	-	-		*5,222	22	*25,589	564	232,008	16
.46		*	*	-	-		*4,717	4	*12,351	1244	135,048	15
.47		*	*	-	-		*6,858	4	*19,283	662	118,500	16

[a] value rounded to the nearest integer

[b] p = present/ a = absent/? = sample not yet sorted

[c] asterisk indicates high score, i.e., 75th percentile or larger, for lithics/qcm = 758, for g Shell/qcm = 1649 g, for g Fcr/qcm = 1415 g

In order to allow for at least general comparability among concentrations and different sections of the study area, four general deposit/activity categories were developed. Each concentration was assigned to the category that seemed to best fit it. Additional inferences about the prehistoric activities associated with the remains were made for many of the concentrations and are described below. The general deposit activity categories are:

(1) Primary deposit, limited activities: these concentrations were characterized by low density, low artifact diversity and a narrow range of types of remains.

(2) Primary deposit, wide range of activities: these concentrations were characterized by a higher diversity of artifact types and a wider range of types of remains than (1), but by less dense deposits than (3) or (4).

(3) Secondary deposit, shell midden: these concentrations were characterized by high densities of shell, but relatively low densities of other remains; the range of types of remains is not as wide, nor the diversity of artifact types as large as for (4).

(4) Secondary deposit, general midden: these concentrations had high densities of two or three kinds of remains, a wide range of kinds of remains and, usually, a high diversity of artifact types.

Fort Hill Concentrations

Seventeen concentrations from Fort Hill are included in this analysis. The largest percentage of them (41%) were categorized as general middens (Table 16.13; Figure 16.3). The concentrations, even those classified as primary/limited, tended to have relatively wide ranges of kinds of remains. For example, 75% of the primary/limited concentrations at Fort Hill contain prehistoric pottery, albeit in small amounts, while only 50% of the concentrations in the same category at 19BN374 contain any pottery.

Among the concentrations in the general midden category fcr is less dense and pottery less frequent than they are among general middens in the sites on the southern side of Salt Pond (Table 16.12). Considering all Fort Hill concentrations that were analyzed here, a smaller percentage has high fcr densities than in any other part of the study area (Table 16.12). These patterns may mean that cooking activities were less frequent, or more concentrated spatially, at Fort Hill.

Three of the general midden concentrations, 308.33, .42 and .71, had faunal remains of over 100 g. The percentages by weight

TABLE 16.13: Deposits and Activities, Fort Hill Concentrations

Primary Deposits		Secondary Deposits	
Limited Activities	Wide Range of Activities	Shell Midden	General Midden
308.24	308.34	308.22	308.11
.31	.43		.14
.41	.51		.21
323.24	323.21		.33
	.23		.42
			.71
			323.22

TABLE 16.14: Deposits/Activities for Concentrations on the Southern Side of Salt Pond

Primary Deposits		Secondary Deposits	
Limited Activities	Wide Range of Activities	Shell Midden	General Midden
273.11	274.22		274.12
274.11	341.22		341.21
			.23
			.24

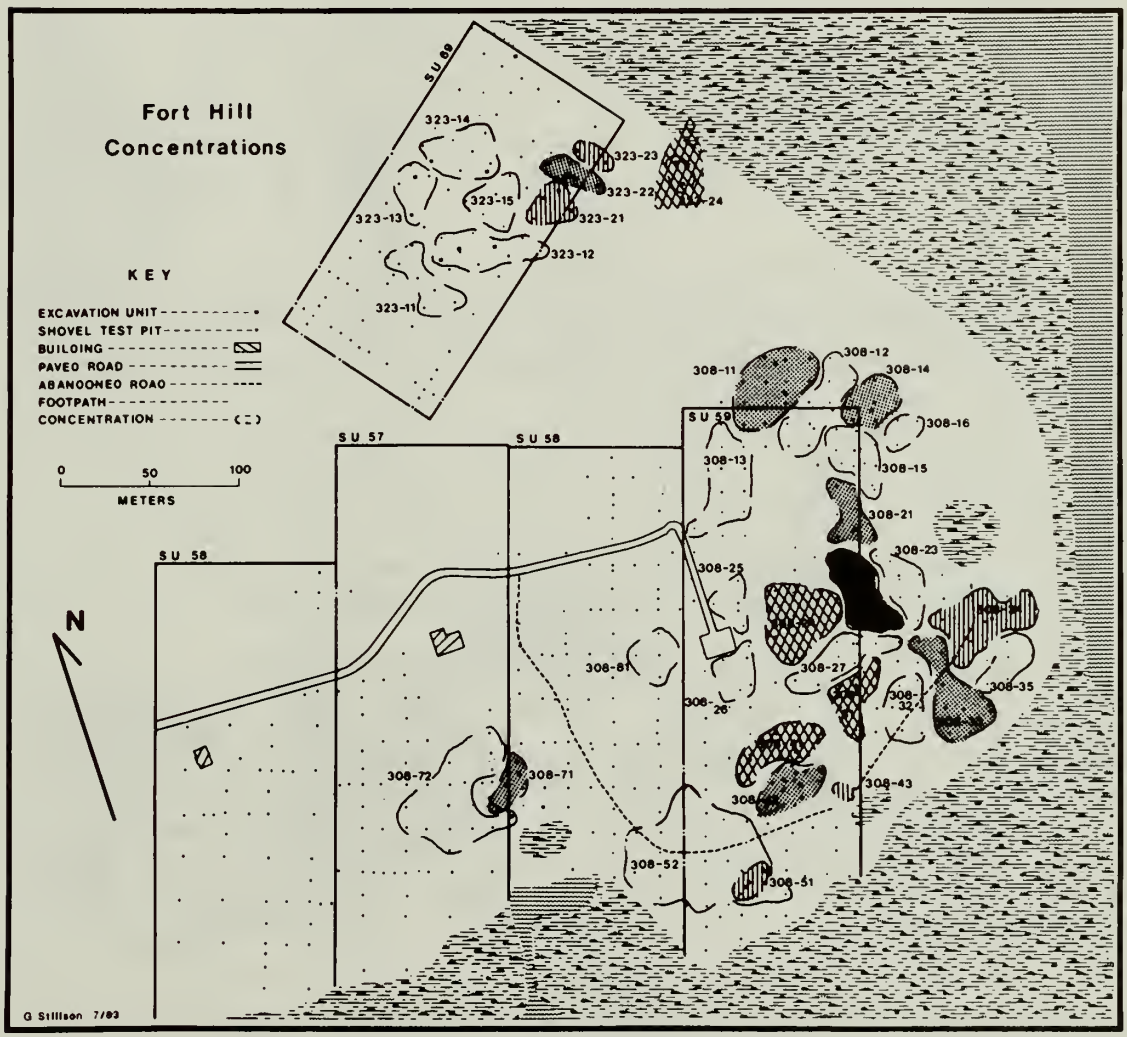
KEY (FIGURES 16.3 - 16.6)

SECONDARY DEPOSIT, GENERAL MIDDEN

SECONDARY DEPOSIT, SHELL MIDDEN

PRIMARY DEPOSIT, WIDE RANGE OF ACTIVITIES

PRIMARY DEPOSIT, LIMITED RANGE OF ACTIVITIES



Deposit/Activity Types, Fort Hill

FIGURE 16.3

of bird, fish, and mammal remains that were recovered by hand excavation in the three concentrations are not substantially different, excepting the .9% of fish for 308.42, as compared with 10% and 6% for the others (Table 16.5). This suggests similar subsistence activities as they relate to these types of food resources. The same kinds of faunal remains recovered using flotation suggest less homogeneity in subsistence. In Concentration 308.71 the percentage of fish by weight is far greater than the other two, as well as being far above the percentage of fish remains recovered by hand excavation at 308.71. This may indicate that fish procurement and/or processing was more intensively done near 308.71 than around the other two general middens.

Concentrations on the Southern Side of Salt Pond

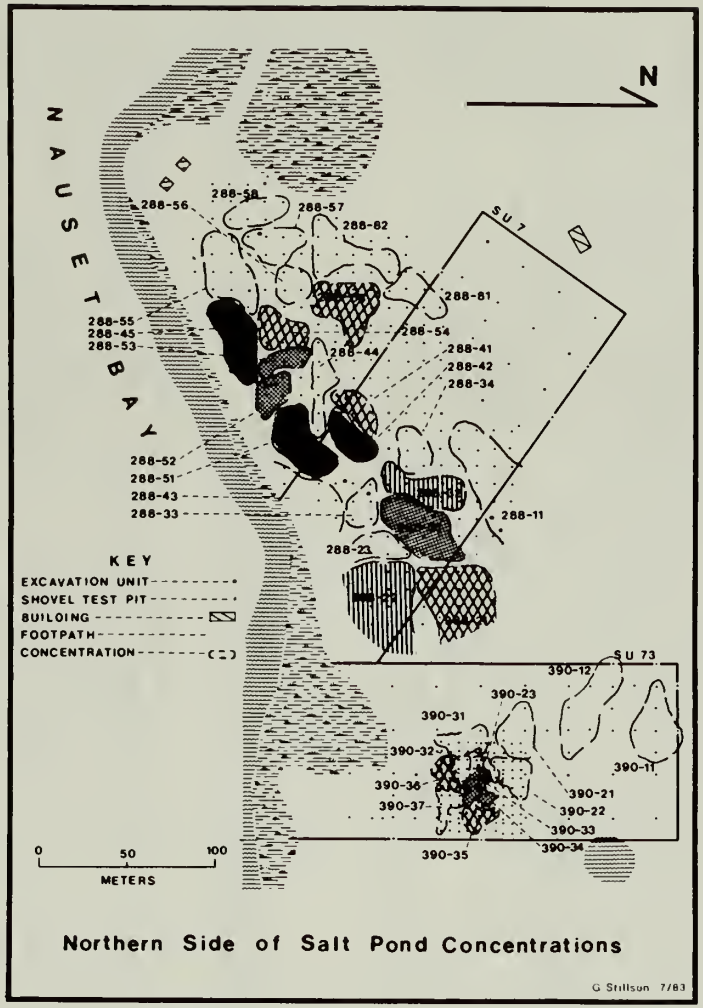
Eight concentrations from the southern side of Salt Pond were placed into deposit/activity categories (Table 16.14; Figure 16.4). The scarcity of primary deposits among these site areas seems apparent from Table 6.14, but it is not real. Most of the concentrations that cannot be dated, and so are not included in this analysis, would fall into one of the two primary deposit categories.

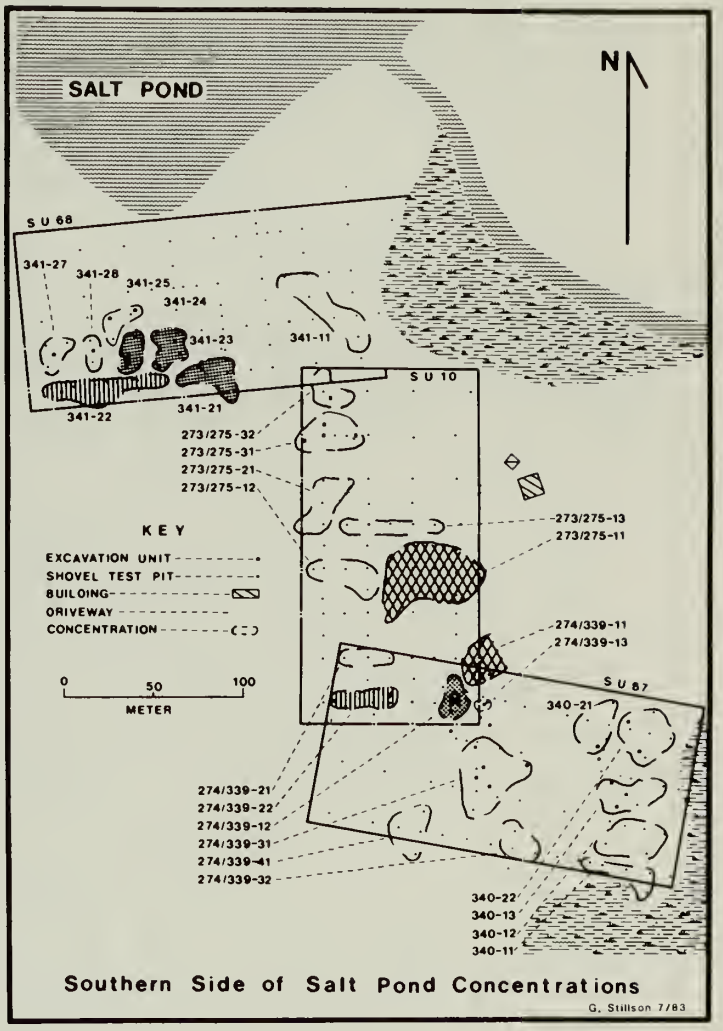
All of the general midden concentrations contain substantial amounts of pottery, faunal remains and fcr; and floral remains were recovered from each of them, as well. Clearly, a wide variety of subsistence and cooking activities were occurring in or around these concentrations. The full range of lithic activities measured in this analysis also were represented in three-fourths of the general midden concentrations. Compared with the general midden deposits at Fort Hill, the four in this area had less dense shell deposits for the most part (Table 16.12). The density of their fcr also was less, but it was more pervasive among the general midden deposits than at Fort Hill.

The faunal remains from hand excavations in the four general midden concentrations are similar in terms of percentage of weight of remains, except for 274.12 which has a very low percentage for fish remains. The percentages by weight for faunal remains recovered using flotation show that both 274.12 and 341.24 have relatively large amounts of fish remains. These percentages may mean that fish procurement and/or processing were carried out more intensively in or around these two concentrations.

Concentrations on the Northern Side of Salt Pond

Eighteen concentrations in this area were assigned to deposit/activity categories (Table 16.15; Figure 16.4). A smaller percentage of these concentrations were general middens (28%) than among the concentrations at Fort Hill or on the





Deposit/Activity Types, Salt Pond Area

FIGURE 16.4

southern edge of Salt Pond (41% and 50% respectively). Among these general midden deposits, pottery and faunal remains other than shellfish were far less frequent than in general middens in the two areas already described. The single exception to this was Concentration 390.33, which contained over 300 g of pottery and from which a large amount of faunal material was collected but has not been sorted completely yet.

The difference in the quantity of faunal remains between general midden deposits at 19BN288 and those at the sites already described raises the issue of whether differential preservation rather than different prehistoric activities is responsible. The former may have had some effect upon the amount of preserved faunal remains. The concentrations at 19BN288 characterized as middens tend to be located at least partially atop a narrow ridge that separates a steep slope down to Nauset Marsh from a less precipitous, but still steep, slope down to the bottom of the kettle hole in the north central part of the site. Vegetation on the ridgetop at present is thin short grass, and some erosion has occurred in these areas and probably is occurring even at present. Some of the test units on the slopes north and south of the ridge suggest considerable slopewash in former times, probably associated with historic period agriculture.

Differential preservation does not seem to have affected the density of other remains, however. The shell and general middens at 19BN288 have values for lithics/qcm, g of shell/qcm and g of fcr/qcm that are in line with similar types of deposits from 19BN308, 323, 274/339 and 341 (Table 16.12). Certainly the density of shellfish remains in the midden deposits at 19BN288 was sufficient to have helped preserve other faunal remains that also were in the midden, and both shell and general middens did contain some faunal material. For the present, the relative scarcity of non-shell faunal remains is considered a function of different prehistoric activities rather than differential preservation. This suggests that subsistence activities involving faunal resources undertaken in or near the middens at 19BN288 were mainly shellfish processing.

Concentrations Along the Northern Shore of Nauset Marsh and at Coast Guard Beach

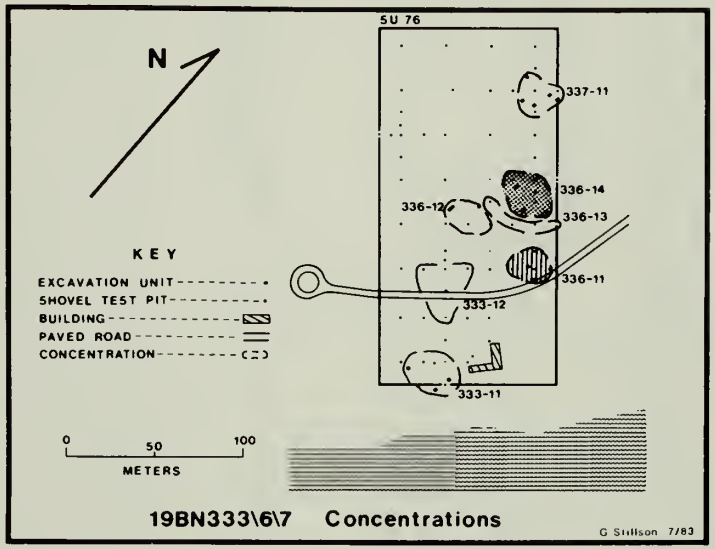
The two sites, including eleven concentrations, that comprise this group present a pattern very different from the other subdivisions of the Nauset area (Table 16.16; Figure 16.5). Concentrations 3316.11 and .14 are straightforward and seem very much like some of the 19BN288 concentrations. At 19BN374, however, very little shell or fcr were found, and only two concentrations among those analyzed here had high density scores for lithic/qcm. All nine of the 19BN374 concentrations were classified as primary, with only one indicating a wide range of activities. Lithic manufacturing activities, especially the

TABLE 16.15: Deposit/Activities for Concentrations on the Northern Side of Salt Pond

Primary Deposits		Secondary Deposits	
Limited Activities	Wide Range of Activities	Shell Midden	General Midden
288.21	288.22	288.42	288.31
.41	.32	.45	.52
.54		.51	.53
.63			390.33
390.22			.34
.31			
.35			
.36			

TABLE 16.16: Deposit/Activities for Concentrations on the Northern Shore of Nauset Marsh and at Coast Guard Beach

Primary Deposits		Secondary Deposits	
Limited Activities	Wide Range of Activities	Shell Midden	General Midden
374.11	336.11		336.14
.43	374.21		
.44			
.45			
.46			
.51			
.54			
.62			



Deposit/Activity Types

FIGURE 16.5

reduction and thinning of general purpose biface blanks, referred to here as secondary manufacturing, was the activity that seems to have dominated the use of the 19BN374 site area (Table 16.10). The primary deposits in this site are unlike many of the ones from other Nauset sites. The latter concentrations tend to have two rather than one of the lithic activities represented, and many have high moderate scores for one of the density variables.

The pattern at 19BN374 points to a limited set of activities centered around the procurement of lithic raw materials, probably from nearby eroding sea cliffs, and the production of bifacial blanks or preforms from this material.

Concentrations at High Head

The sites in the vicinity of High Head in North Truro are the only other substantial grouping of prehistoric sites in the study area. The pattern of deposit/activity classifications is strikingly different from Nauset as a whole or any of the subdivisions of Nauset individually (Table 16.17; Figure 16.6). Even 19BN374 with all primary deposits has a pattern of limited vs. wide range activities classification nearly the exact opposite of the one among the High Head concentrations.

The concentrations in 19BN281 tend to have very high scores for the density of lithics and fcr. In part this is because the artifact-bearing levels at the site constitute a relatively thin soil layer (i.e., 10-20 cm). Therefore, the volumes used to calculate density for 19BN281 test units were relatively small. Almost all test units in other sites had the plowzone as the artifact-bearing stratum. Plowzone thicknesses typically were over 20 cm, and in a few cases ranged to over 70 cm where aggradation of a plowzone due to erosion upslope had occurred. Since density calculations in most sites involved larger soil volumes than in 19BN281, the density values could be lower due simply to the effect of thick plowzones.

Although the density values for 19BN281 may be artificially high, even without the unit volume differences, the scores for these concentrations would be among the highest density scores for lithics and fcr. The chipped stone assemblages in 19BN281 average about 90% quartz, a lithic raw material that produces large amounts of chipped stone residue when it is worked. The abundance of material rather than the volume differential is the real reason why the 19BN281 concentrations have high scores for lithic density.

Unlike the 19BN374 concentrations, many at the High Head sites were designated as representing a wide range of activities. The concentrations typically had indicators of two or all three lithic activities, high scores for either lithics/qcm, g of fcr/qcm or both, and a high number of lithic artifact types (Tables 16.10, 16.11, 16.12). These characteristics indicate

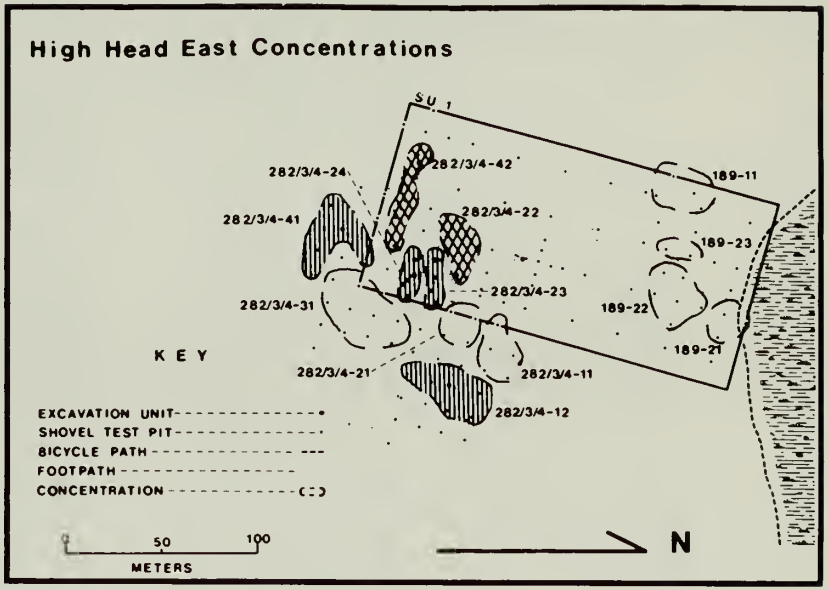
TABLE 16.17: Deposit/Activities for High Head Concentrations

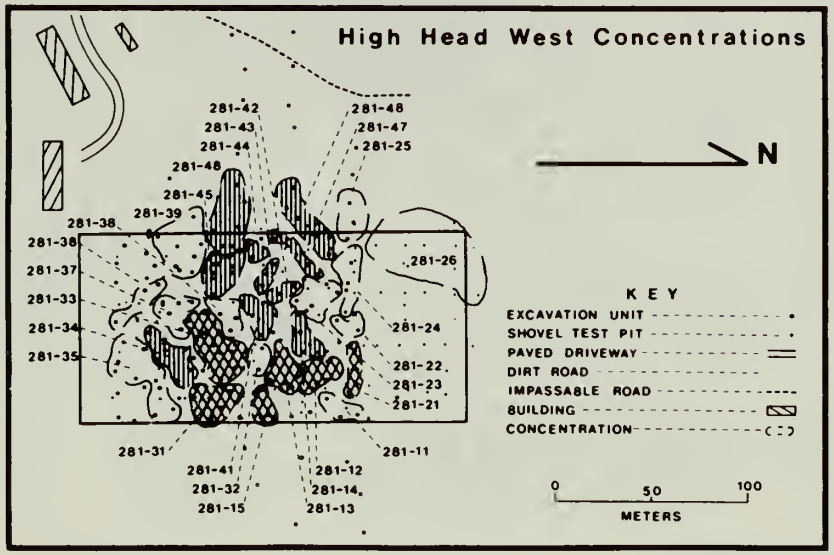
Primary Deposits		Secondary Deposits	
Limited Activities	Wide Range of Activities	Shell Midden	General Midden
355.12	356.21	--	--
282.22	282.12		
.42	.23		
281.12	.24		
.13	.41		
.15	281.14		
.23	.22		
.31	.24		
.33	.25		
	.34		
	.41		
	.42		
	.43		
	.44		
	.45		
	.46		
	.47		
	.48		

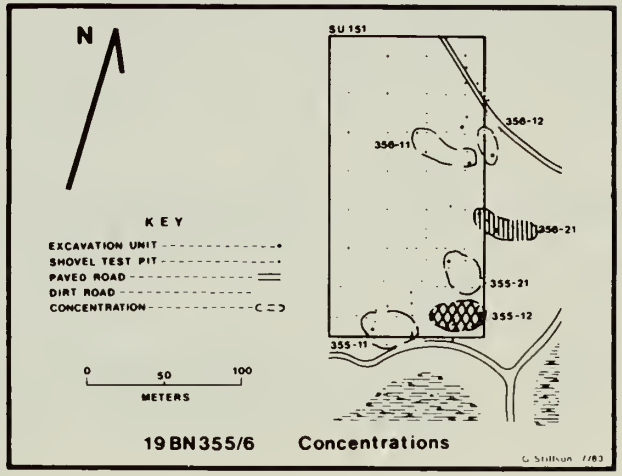
Deposit/Activity Types

High Head

FIGURE 16.6







that a wide range of activities were carried out in the concentration areas.

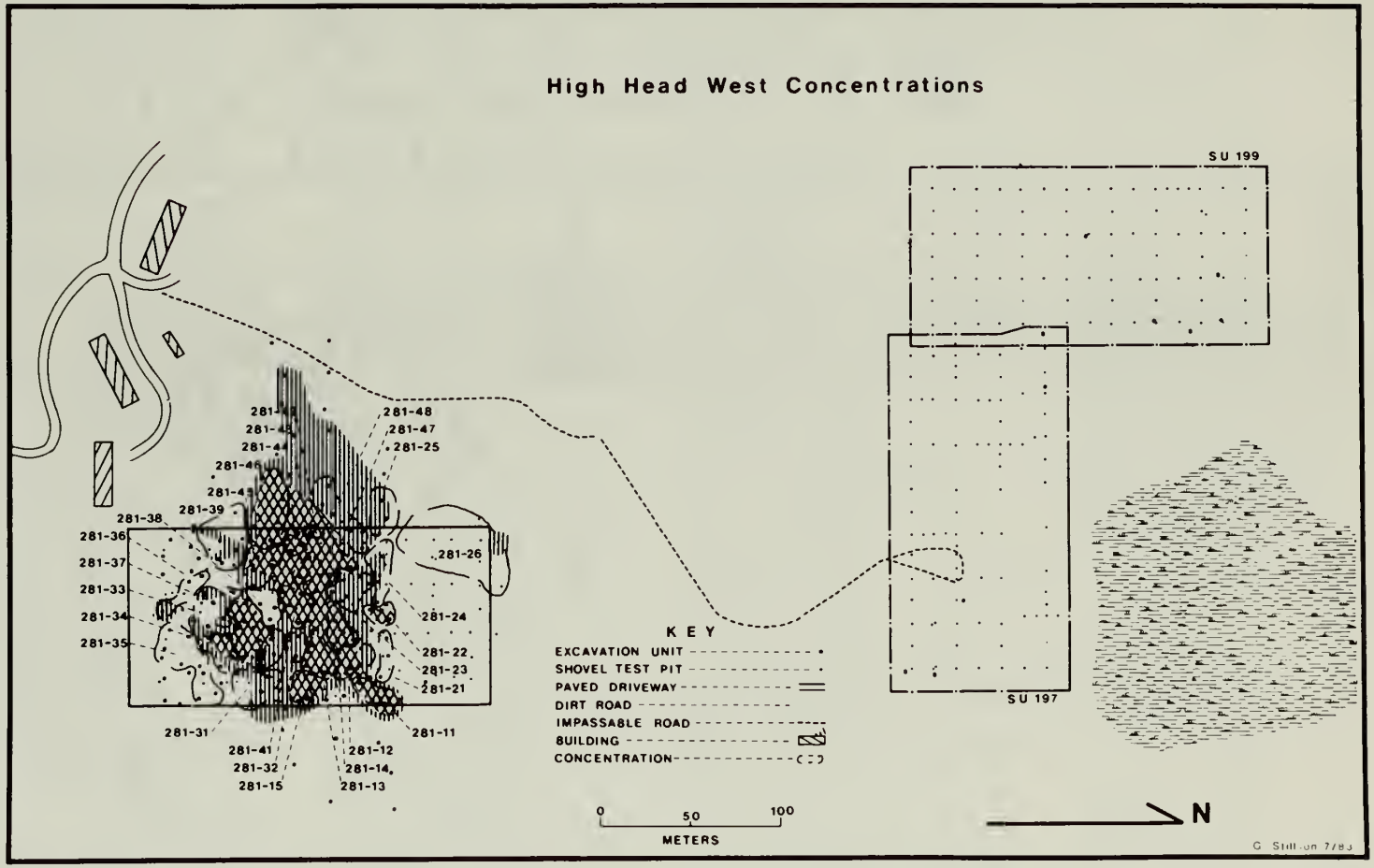
There was a nearly total absence of any of the faunal and floral remains such as were found in the Nauset sites, and were used in this analysis to identify secondary deposits. A question similar to the one posed in the discusion of 19BN288 needs to be answered: is differential preservation responsible for the absence of organic remains, or did no activities that would have generated them occur?

One can infer rather confidently that the scarcity of shellfish remains is due not to poor preservation, but to the fact that the distance to the shellfish beds made the 19BN281 area a poor choice for a location at which to process collected shellfish. We would expect, however, that some remains of other faunal material would have accumulated in substantial midden deposits if the site had been occupied intensively or for long periods. The lack of shell in such midden deposits would have hindered their preservation, yet despite this some apparent remnant, even if only soil staining, would be expectable. The genesis and development of the artifact-bearing soil horizons have not been completely described yet, but there are no obvious indications of former extensive or intensive anthropic soil horizons (see Chapter 7). No features were discovered during the site examination, or in a 5 x 5 m block excavation done during the Fall 1983 field season near the center of the high density .40's concentrations.

Even if it is given that all organic residues, including dense middens, would have totally vanished because of poor preservation, the spatial distributions of lithics and fcr do not indicate that middens ever existed at 19BN281, at least not in the form they are known to have occurred in at other sites already discussed. Most of the concentrations at Nauset with subplowzone midden deposits (308.33, .42; 341.21, .23, .24) have very high densities of lithics and fcr (Table 16.12). However, these concentrations cover much smaller areas than the area of dense lithics and fcr at 19BN281. Ironically, it seems that even the extensive distribution of dense lithics and fcr at 19BN281 is evidence that midden deposits, at least as they have been recorded at the other sites, never existed there.

The absence of midden deposits or any trace of their remnants strongly suggests that the site was not occupied and used intensively by a large group for a long period of time. Unlike several of the general midden deposits in the Nauset area (e.g., 308.33, 341.21, .23, .24), the archeological remains do not indicate anything like a village settlement.

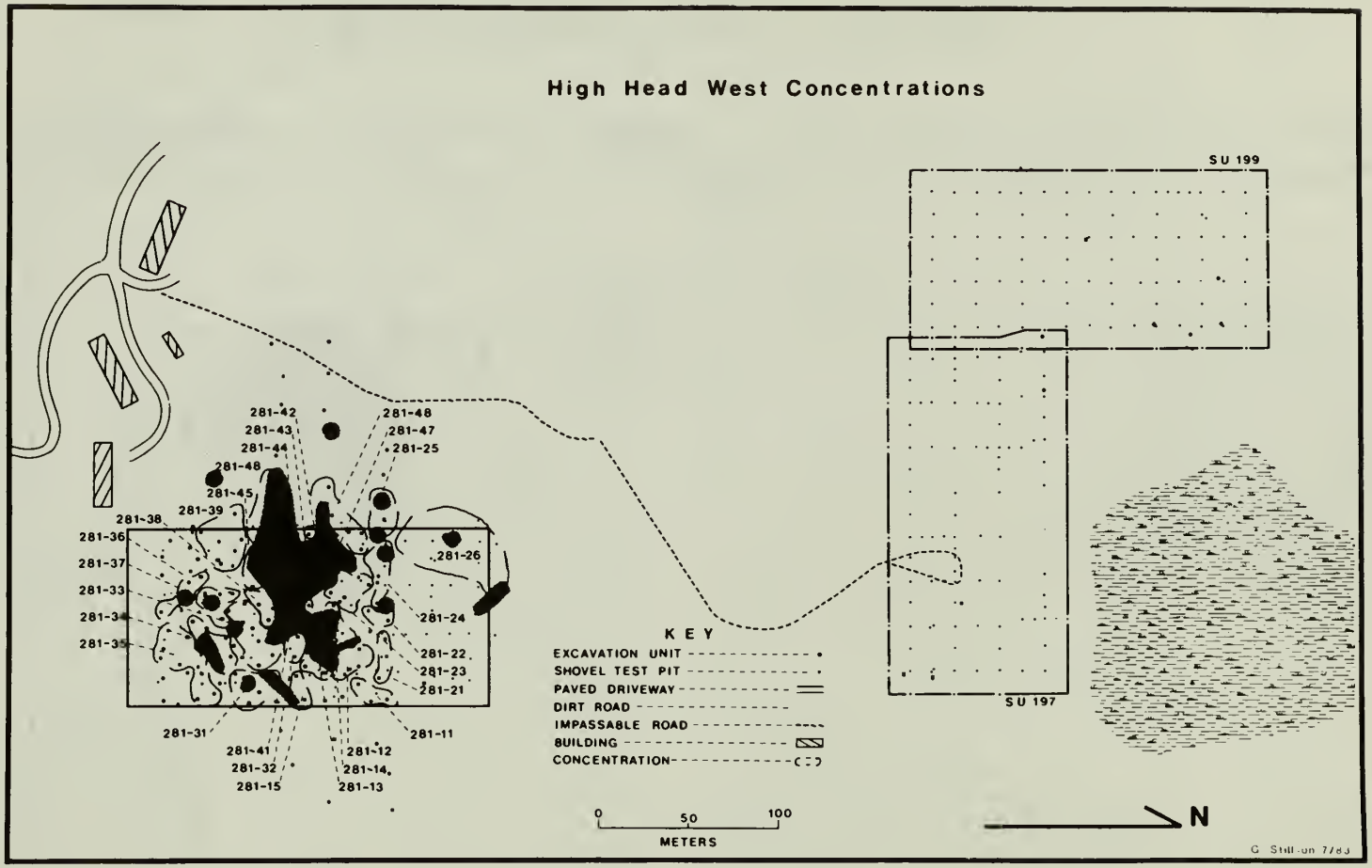
By what process, then, could this large area (19BN288 is the second largest prehistoric site, following 19BN308) with admittedly very dense lithic artifact and fcr deposits have been created? It may be that a long-term series of small occupations



MEDIUM DENSITY LITHICS/qcm— — HIGH DENSITY LITHICS/qcm— —

Spatial Distribution of High and Medium Density Scores for Lithics, 19BN281

FIGURE 16.7



HIGH DENSITY gFCR/qcm – – – –

Spatial Distribution of High Density Scores for Fire Cracked Rock, 19BN281

FIGURE 16.8

by small groups of individuals of the same general vicinity resulted in the creation of a palimpsest at 19BN281. The distributions of chipped stone artifacts and especially the fcr within the site area indicate such a site formation process (Figures 16.7 and 16.8).

In this scenario, small, short-term occupations would have covered the site area, with what is now the center of the site more frequently the locus of occupation. The fcr distribution illustrates particularly well how the remnants of this scenario could be expected to appear. The small outlying fcr clusters represent the remnants of individual or small numbers of one-time occupations, and the large central cluster represent repeated overlapping reoccupations of the same vicinity.

If this interpretation is correct, the activities associated with the 19BN281 concentrations would be ones involved in the exploitation of resources, probably mainly or exclusively for subsistence, in the general area.

19BN282/3/4 has intrasite distributions of lithic artifacts and fcr similar to those of 19BN281, although on a smaller scale. Its lithic assemblage, which contains far less quartz, reflects a different technology, at least regarding raw material. Like 19BN281, no midden deposits were found, and the same interpretations of this as were made for 19BN281 can be made for 19BN282/3/4.

A Summary of Deposits and Activities

Inferences were made about the types of deposits and activities that occurred in 81 concentrations from 13 sites in 5 different areas (Table 16.18). Since it is from the data on these concentrations that inferences about prehistoric adaptations will be made, consideration of how accurately this 81-concentration sample reflects the characteristics of the entire 176-concentration data set is relevant, indeed perhaps even overdue.

It is predictable that concentrations with the densest deposits also would be the ones that contain chronological data. As Table 16.19 shows, this is the case. Concentrations without dense remains of lithics, shellfish remains or fcr compose 53% of the population of concentrations, but only 30% of the sample. The relative frequencies of concentrations are about equal, 22% and 25% respectively. The relative frequencies of concentrations of dense remains are also lopsided. Only 24% of the population, but 46% of the sample, have two or three types of dense remains.

This means that concentrations without dense remains are underrepresented in the sample. Since all of the concentrations in the sample that did not have dense remains were interpreted as primary deposits (Table 16.10; also see the maps of each site),

TABLE 16.18: Summary of Deposit/Activity Designations, Concentrations with Chronological Data

	Deposit/Activity								
	Primary Deposits				Secondary Deposits				
Area	Limited Activities		Wide Range of Activities		Shell Middens		General Middens		Total Concs.
Fort Hill	4	24%	5	29%	1	6%	7	41%	17
Southern side of Salt Pond	2	26%	2	26%	--	--	4	50%	8
Northern side of Salt Pond	8	44%	2	11%	3	17%	5	28%	18
Northern side of Nauset Marsh and Coast Guard Beach	8	73%	2	18%	--	--	1	9%	11
High Head	9	33%	18	66%	--	--	--	--	27
									81

TABLE 16.19: Comparison of Population of Concentrations with Sample of Concentrations with Chronological Data

	Population						Sample					
	# of Types of Dense Remains						# of Types of Dense Remains					
Area	0		1		2-3		0		1		2-3	
Fort Hill	17	10%	8	5%	10	6%	6	7%	3	4%	8	10%
Southern side of Salt Pond	18	10%	4	2%	5	3%	1	1%	3	4%	4	5%
Northern side of Salt Pond	10	6%	14	8%	12	7%	4	5%	4	5%	10	12%
Northern side of Nauset Marsh and Coast Guard Beach	27	15%	4	2%	1	1%	7	9%	3	4%	1	1%
High Head	22	13%	9	5%	15	9%	6	7%	7	9%	14	17%
	94	53%	39	22%	43	24%	24	30%	20	25%	37	46%
	Total population size = 176 (100%)						Total sample size = 81 (100%)					

many of the concentrations that were not included in the sample probably represent primary deposits that indicate areas where various types, numbers and ranges of activities occurred at one or more unspecified times during the prehistoric period.

The relative frequencies of concentrations with different densities of remains in the population and the sample in specific areas are roughly comparable. Typically there are only a few percentage points difference. The largest differences are 9% fewer concentrations without dense remains on the northern side of Salt Pond in the sample than in the population, and 8% more concentrations with dense remains in the High Head sample than in the population. In no instance is the difference 10% or more. The sample seems to be a reasonable projection of the population with the caveat described in the last paragraph.

The discussions of concentration deposit types and activities in this chapter have not described the specific activities that might be inferred for most of the primary deposits. The exceptions to this are the concentrations in 19BN374 which seem to have resulted predominantly from lithic manufacturing activities. Mainly, the primary deposits seem to represent generalized activity areas. Some of the primary concentrations contain densities of shellfish remains that are near or just above the 1649 g/qcm value above which scores were designated as high. Perhaps this indicates that some shellfish processing, or manufacturing using shell, was carried out in these areas (e.g., 308.24, .31; 323.23; 288.41, .54; 336.11; 374.62). They clearly should not be considered shell middens or general middens with substantial shell remains. The values for g/qcm of shell in plowzone levels above subplowzone middens that include dense shell layers ranged from nearly 20,000 to nearly 120,000 g/qcm (Table 16.20), several orders of magnitude above the values for any primary deposit. The inferences about lithic tool manufacturing and maintenance are based upon very general criteria (see Chapter 9). Except for most of the concentrations in 19BN374, many concentrations, primary or secondary, have more than one lithic activity represented. The number of lithic activities inferred and the number of lithic artifact types were two of the main factors considered when distinguishing between limited and multiple activity designations for primary deposits. The distinction was as much qualitative as quantitative, however.

It is clear that a variety of activities occurred, and that, with the exception of most of the 19BN374 concentrations, specific manufacturing activities were not consistently carried out in specific locations. It may be that the differences in assemblage characteristics that were used to distinguish limited activity areas from multiple activity areas are also a function of length of occupation. The variety of activities performed in a location will increase the longer the location is used, to the extent that the activities performed vary during the period of use. The longer a site was occupied, the greater the possibilities for created artifacts to be lost or discarded.

TABLE 16.20: Density of Shell Remains in Plowzone Levels above Subplowzone Middens Containing Dense Undisturbed Shell Layers

Concentrations	Total Shell (g/qcm)
308.33	118,979
308.42	18,782
308.71	194,350
288.42	20,169

Binford (1979) described a situation in which the variety of lithic raw materials used for stone tools at a site was a function of the length of occupation.

At this point the deposit and activity analysis has provided some general notions about the prehistoric human adaptations on the outer Cape. This especially is so regarding economic activities and spatial organization, and these are described briefly below. The niche dimensions of seasonal organization and external cultural contact require that additional data be presented in subsequent sections of this chapter. The economic activity and spatial portion of the spatial/seasonal dimension also are presented more fully in later sections.

The lithic assemblages, pottery and organic remains and fcr indicate that combinations of various activities were carried out in most concentrations. Only the 19BN374 concentrations seem to imply a very specialized set of activities, and even among them, there are several with some remains (e.g., pottery, shellfish) that are inconsistent with strictly lithic manufacturing activities, and may indicate limited other uses. The general point here is that special purpose activity locations are either very rare or archeologically invisible. By the latter is meant that they existed in systemic context, but left insufficiently obtrusive remains to be discovered by the field methods and techniques used by the survey.

The range of lithic manufacturing and subsistence activities seems rather wide. All stages of manufacturing are present, and seem to have been carried out at different levels of intensity in a variety of locations. A wide variety of lithic raw materials were used for tools, and the tool kit included a wide range of bone tools also (Ritchie 1969; Ross Moffett collection, R. S. Peabody Foundation for Archaeology, Andover, MA). A wide range of fauna seems to have been exploited since bird, fish and mammal remains have been found in addition to shellfish in many of the middens.

Finally, the spatial organization is varied both within the Nauset area and between Nauset and High Head. At Nauset the Fort Hill and Salt Pond areas contain almost all of the midden deposits. The concentrations along the northern shore of Nauset Marsh and at Coast Guard Beach are far less dense and diverse. Indications are that these areas were not used as intensively or by as large a population as the area around and south of Salt Pond.

The differences between High Head and Nauset are even more striking. The former contains no deposits classified here as secondary, although lithics and fcr do occur in dense deposits in a number of the concentrations there.

These characteristics of the concentrations and the variation in their spatial distribution provide a variety of

insights into the nature of prehistoric land use and cultural adaptations. The next sections builds upon the activity analysis and spatial distribution data just described and examined by adding to it information about seasonal organization and external cultural contact. Together these data are used to describe prehistoric cultural adaptation during particular time periods. The final sections of this chapter present interpretations of prehistoric adaptations, and discuss their implications in light of the current interpretations described in Chapter 5.

Seasonal Organization

In the framework for niche analysis presented in Chapter 5, seasonal and spatial organization were linked as a single dimension of niche. The availability of data about seasonal and spatial organization, however, turned out to be rather disproportionate. Spatial data could be generated at several scales for each concentration, but seasonal data were very specific and available for relatively few concentrations. Therefore, seasonal organization is considered separately here.

The original aim was to collect data in each site on a variety of remains that could indicate season of occupation. Three major problems prevented the completely successful accomplishment of this goal. First, although a hefty percentage of sites contained data that were suitable for seasonality analysis, these data were spatially clustered in the site. Therefore, only a few of the concentrations in any site contained suitable data for seasonality analysis. The second problem is one common to seasonality studies (Monks 1981). Few archeological remains provide direct evidence about the season of site occupation; assumptions about the scheduling of resource procurement and the occupation of a site usually are necessary. For example, the presence of carbonized nut remains at a site might indicate the processing of nuts, a fall activity, at the site. On the other hand, the nuts might have been processed elsewhere, transported later in an annual cycle to the site they eventually were found at and discarded or lost there at yet another time of the year. This also points out a third problem in seasonality analysis-- the precision of season of exploitation estimates. Some data permit only general inferences about the season during which they were exploited. Again to consider nuts, they probably were collected and processed mainly during the fall when they ripen. Since nuts are available for harvest during a period of several months, estimating the precise month in which they were harvested is impossible. On the other hand, some organic remains permit more precise estimates of the timing of procurement. These typically are the remains of species that generate some form of daily or monthly growth marker such as some

TABLE 16.21a: Concentrations and Components with Seasonality Analysis

Concentration	Component
308.11	Late Woodland
308.33	Late Woodland
308.42	Late Archaic Late Woodland
308.71	Late Middle to early Late Woodland
323.21	Late Woodland
323.22	Late Woodland
323.23	Late Woodland
274.11	Late Archaic
274.12	Middle Woodland
341.21	Middle Woodland to early Late Woodland
341.24	Late Woodland
288.42	Late Woodland
288.52	Late Woodland
390.33	Middle Woodland
410	Late Woodland

types of fish vertebrae, mammal teeth and shellfish species.

Due to the apparent abundance of shellfish remains in many of the sites examined by the survey, seasonality analysis through the inspection of growth lines in shell, specifically Mercenaria mercenaria, was selected as a means of obtaining information on the season of occupation and activities in concentrations. A pilot study done in 1981 (Hancock 1981) showed promising results and eventually 16 components in 15 concentrations and 7 sites were analyzed (Table 16.21a). Hancock (see Chapter 12) provides a detailed description of the techniques and identification criteria. Her study included the collection of modern Mercenaria mercenaria individuals and the examination of growth line variation during the course of a year.

The results of the shell seasonality study (Table 16.21b) inform us directly only about the scheduling of shellfish collecting and processing. Closer examination of the link between the shell and other remains in undisturbed archeological context may permit inferences about the seasonality of other activities. For this analysis, however, the inferences were be limited to shellfish collecting and processing.

The righthand portion of Table 16.21b shows the seasonal pattern of shellfish collecting for Late Archaic through Late Woodland components. Some of the specimens could be assigned to a specific month of collection; for others a range of two to three months was assigned. Note the very large percentages of specimens for which only a general growth phase could be determined or that were too weathered for any estimate of season of collection to be made.

Visual inspection of the data (Table 16.21) indicated that between the Middle and Late Woodland periods a change occurred in the seasonal organization of this activity. Two of the Late Archaic and Middle Woodland components indicate that shellfish collecting was carried out during about two-thirds of the year. Most of the shell was collected during the winter and early spring, but a sizeable portion in the 308.42 and 341.21 samples were collected during the summer. Both of these components were dated by association with C-14 dates (Table 16.7). Late Woodland components, by contrast, indicate mainly or exclusively winter and early spring collection times.

The meanings of the seasonal patterns and the apparent temporal change are not fully understood. The pattern of

TABLE 16.21b: Seasonality Information Based upon Shellfish Analysis

Time Period(s)	Conc.	Number of Shell Specimens[a] W	GP	T	No. of Specimens/Month J F M A M J J A S O N D
LA	308.42	1(11%)	4(44%)	9	
LA	274.11	0	1(20%)	5	
MW-LW	308.71	17(71%)	5(21%)	24	
MW	274.12	8(73%)	2(18%)	11	
MW-LW	341.21	10(20%)	12(24%)	50	
MW	390.33	2(25%)	1(13%)	8	
LW	308.11	1(13%)	6(75%)	8	
LW	308.33	1(20%)	1(20%)	5	
LW	308.42	18(34%)	14(26%)	53	
LW	323.21	4(66%)	1(17%)	6	
LW	323.22	17(27%)	34(54%)	64	
LW	323.23	4(33%)	6(50%)	12	
LW	341.24	0	2(100%)	2	
LW	288.42	19(35%)	13(24%)	55	
LW	288.52	5(26%)	12(63%)	19	
LW	410	4(50%)	0	8	

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[a]Data taken from Chapter 12. Key: W = too weathered to record; GP = estimate of slow vs. fast growth phase only; T = total number of specimens.

seasonal exploitation contradicts interpretations that shellfish were used year-round by coastal populations to avoid the cycle of seasonal movement that is inferred for inland populations (Ritchie 1969:vii). At the same time, it runs counter to Snow's (1980:230) assumption that Late Archaic coastal sites with abundant shellfish remains were mainly summer occupations.

The scheduling of shellfish exploitation during the winter and late spring may be related to the notorious scarcity of other wild food resources at that time of the year. Although shellfish collection during the winter might have involved accepting wet, cold and generally uncomfortable working conditions, they were an abundant available source of food when other sources were rare.

The apparent change of shellfish exploitation scheduling in the Late Woodland from winter through summer to winter alone might be related to increased attention being paid to the planting and care of cultivated crops during the Late Woodland. The tending of cornhills between planting time and harvest, typically a chore of women and children, required a substantial amount of time among the Huron (Heidenreich 1971:178-179). In his 1634 account of the natives of eastern New England Wood described the planting and tending of corn as a primary responsibility of women (Vaughan 1977:113). If the Late Woodland inhabitants of Nauset had developed similar responsibilities for horticultural products by the Late Woodland, they might have had to make a scheduling choice and eliminate the time available for summertime shellfish harvesting and processing. Wood also noted that women were the collectors of shellfish, and that when he observed it, shellfish collecting was a winter activity (Vaughan 1977:114).

Cleland (1976:71-73) has characterized late prehistoric cultural adaptations in much of eastern North America as focusing upon corn and other domesticated plants, although he notes that the intensity of the focus on these resources varies with the natural environmental conditions that govern the growing season. The apparent change in scheduling of shellfish exploitation during the Late Woodland might be an example of the scheduling changes that Cleland infers as having been concommitant with a greater concentration on horticultural products for subsistence. This is not to sugest that if such a shift occurred on the outer Cape it was sudden or final. Rather, there was a shift in emphasis in subsistence resources with horticultural activities being allocated more time by the late prehistoric populations.

At this point, the analysis of the seasonal organization that was involved with other resources and activities is incomplete. The analysis of shellfish collection, however, indicates two points about the larger issue of characterizing the cultural adaptations during the three periods under study and identifying temporal variation among them. The most important finding, perhaps, is the strong association of shellfish

collecting with winter and early spring. As noted above, this runs counter to existing interpretations of this activity.

The second major point is that the results indicate that from at least the Late Archaic onwards there was at least winter settlement on the coast of the outer Cape, and in all likelihood summer settlement as well. This also runs counter to a recent interpretation that coastal settlement in southern New England was a product of the trade due to European contact (Ceci 1979, 1982).

External Cultural Contact

The purpose of this dimension was to measure the extent of communication with contemporaneous nonlocal populations. Extralocal communications and relationships might have contributed to successful adaptations in several ways. Information on resource availability or scarcity, as well as cultural innovations that might have improved local adaptations, could have passed through extralocal communication channels. They also would have provided the opportunity for a more widespread, larger mating network which might have been important for the ultimate survival of local populations. Finally, in the event of a local environmental catastrophe, resources from associated nonlocal populations may have helped the the local population weather the poor situation and survive.

The measurement was made operational by recording the relative frequencies of artifacts made of nonlocal lithic raw material in all the concentrations (see Chapter 15). Cryptocrystalline silaceous lithics frequently referred to as "jasper", "flint" and "chert" were the type of material classified as nonlocal exotics. For convenience the term chert was used here to refer to such materials. Local geology and geomorphology, plus limited field inspection of cobble deposits, indicate that chert is either extremely rare or nonexistent in the outwash and till deposits that compose the surface geological deposits of the outer Cape (see Chapters 4 and 15). It was assumed for this analysis that any chert found in archeological context had been humanly transported to the area.

In Chapter 5 it was noted that several recent studies have pointed out the relatively high percentages of cherts in Early and Middle Woodland assemblages in southern New England. One aim of this analysis was to check whether a similar pattern existed among the concentrations examined by this study, in terms of both the relative frequency of occurrence and the extent of occurrence. A third characteristic of interest was the types of artifacts that were made of the exotic material.

As far as the apparent overall pattern of occurrence is concerned, the outer Cape data conforms to it (Table 16.22). A

TABLE 16.22: Percentages of Concentrations with Chert by Time Period

Period	Number of Concentrations with chert / total	Percentage with chert
Late Archaic	5 / 38	13%
Middle Woodland[a]	7 / 9	78%
Late Woodland	17 / 29	59%

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[a]includes concentrations with MW and LW primary components and those with components that seem to span the EW-MW or MW-LW boundaries (see Table 16.9).

much higher percentage of concentrations dated to the Middle Woodland contain some chert in their assemblages than is the case for Late Archaic concentrations. Late Woodland concentrations with chert are over half of the total, but still about 20% below the level of Middle Woodland concentrations.

The amount of chert in assemblages also varies by time period (Table 16.23). Note that percentages of 1.0 and above can be regarded as relatively high given the overall distribution of chert percentages per concentration (see Chapter 8; see also this chapter, section "Concentrations Dated by Diagnostic Lithics and Ceramics"). Note further that some high percentages should be discounted because they result from the presence of a single artifact, typically a trim flake, in a small assemblage.

Visual inspection of the percentages/concentration showed clearly that the Middle Woodland assemblages consistently have the highest percentages of chert. Four of the Late Woodland assemblages have values of 1.0% or above, while six of the Middle Woodland ones do, although one of those (288.54) is based on two artifacts in a total assemblage of only 74. The Middle Woodland assemblages, then, not only have an overall higher percentage of chert occurrences. They also have more assemblages in an absolute sense and larger percentages of chert individually.

This pattern conforms to the one derived from the current interpretations, although the extent of use of exotic lithics may have varied from that in other parts of southern New England. Both Feder (1981) and Barber (1982a) report that relatively large percentages of the Early or Middle Woodland assemblages that they analyzed were exotic lithics. Barber's figures for the Wheeler's site in northeastern Massachusetts are 46% of all the flake types by count and 23% by weight. Those magnitudes of occurrence in an individual assemblage are many times greater than in any of the Middle Woodland assemblages from the survey. This difference in the outer Cape assemblages may reflect a different type, intensity, or frequency of communication than is represented by sites with larger percentages of exotic material, such as the Wheeler's site.

The types of artifacts in the Cape assemblages that were made from chert are mainly trim flakes; the second most frequent type were projectile points, specifically Jack's Reef corner-notched points. This pattern indicates that finished artifacts or at least bifacial preforms or blanks were the items being transported, rather than blocks or cobbles of raw material.

The temporal variation in the relative frequency of chert among the concentrations indicates a major shift between the Late Archaic and the Middle Woodland. There is very little indication of the type of contact and material transport inferred for the later periods during the Late Archaic. Following the Middle Woodland there seems to have been a reduction in the amount of exotic material coming to the outer Cape, but it remained at a

TABLE 16.23: Percentages of Chert in Concentration Lithic Assemblages

Concentration	Period	% Chert	Number of Lithics in Assemblage
274.11	LA	2.9[a]	34
288.51	LA	1.2	245
390.34	LA	.4[a]	111
282.23	LA	.1[a]	850
281.23	LA	.9[a]	107
308.42	MW,LW	1.2	691
.43	MW	7.9	267
.71	MW-LW	3.7	218
274.12	MW	3.9	2139
341.21	MW-LW	.2	2717
288.54	EW-MW	2.8[b]	72
390.33	MW	1.0	305
308.11	LW	.1	2067
.14	LW	1.0	1954
.21	LW	.6	167
.33	LW	2.9	209
.34	LW	.2	636
.51	LW	.2	1125
323.21	LW	1.0	488
.22	LW	.5	2569
.23	LW	.4	231
.24	LW	1.9[a]	53
341.23	LW	.03	3107
.24	LW	.1	4157
288.22	LW	1.3[a]	77
.31	LW	.2	524
.52	LW	1.8	1062
374.45	LW	.9	302
.46	LW	.4	466

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[a]one artifact

[b]two artifacts

much higher level than existed prior to the Middle Woodland. The continuation of chert use during the Late Woodland runs counter to the existing interpretation that during the Late Woodland widespread communications declined, so that by European contact a pattern of river basin territoriality, and a preponderant use of local lithic materials similar to the Late Archaic pattern, was reestablished (Dincauze 1973:41). Of course, the frequencies of occurrence of exotic lithics are relatively small for all of the Late Woodland concentrations. The amount of use seems never to have been substantial even during the Middle Woodland. These materials may not have played prominent roles in the lithic technology of the later prehistoric periods. Their pervasiveness among the later assemblages, however, suggests a steady external cultural contact from at least the Middle Woodland onwards.

Economic Activities and Spatial Organization

Unlike the data on seasonal organization and external cultural contact, which were available from relatively few concentrations, nearly all the concentrations for which satisfactory chronological interpretations were made could be considered vis-a-vis economic activities and spatial organization. Furthermore, these are closely related aspects of cultural adaptation. The spatial distribution of activity loci, for example, informs us a great deal about activity integration. Finally, they were considered together because the current interpretations of prehistoric cultural adaptations seem to suggest that although economic activities *per se* may not have varied much during different prehistoric periods, the integration and spatial distribution of activities may have. A closely linked analysis of these two dimensions made the detection, description and analysis of this pattern easier.

Among the concentrations for which deposit and activity types were identified and those with chronological data described in the opening sections of this chapter, 75 concentrations were selected for this analysis of economic activities and spatial organization. These concentrations were subdivided into three general chronological groups, and arranged geographically within the groups. The chronological groups are: Late Archaic concentrations (Table 16.24), Middle Woodland concentrations (Table 16.25) and Late Woodland concentrations (Table 16.26). Concentrations with multicomponent deposits were placed within one or another group based upon the predominant component. In three cases unmixed second components were recognized and dated. The buried and distinct Late Archaic components at 308.00, 308.33, 308.42, and 390.33 were included in this analysis, although they are not listed on Table 16.24.

Late Archaic

Thirty-eight concentrations had predominantly Late Archaic

TABLE 16.24: Concentrations with Primary Components from the Late Archaic

	Deposit/Activity Types						
	Primary Deposits		Secondary Deposits		Lithic Activities[a]		
Conc.	Limited Activities	Wide Range of Activities	Shell Midden	General Midden	1	2	3
274.11	*					*	*
.22		*				*	*
288.21	*				*		
.32		*			*	*	*
.41					*		
.51			*		no high scores		
.63	*					*	*
390.31	*					*	*
.34				*		*	*
.35	*					*	*
.36	*					*	*
355.12	*					*	*
356.21		*			*		
282.12		*			*	*	*
.22	*					*	
.23		*				*	*
.24		*				*	*
.41		*				*	*
.42	*				*		
281.12	*						
.13	*				*	*	
.14		*			*	*	
.15	*					*	*
.22		*			*	*	*
.23	*					*	*
.24		*			*	*	
.25		*			*	*	*
.31	*				*	*	
.33	*				*	*	
.34		*				*	*
.41		*				*	*
.42		*			*	*	*
.43		*				*	*
.44		*				*	*
.45		*				*	*
.46		*				*	*
.47		*				*	*
.48		*				*	*
N = 38	16 (42%)	20 (53%)	1 (3%)	1 (3%)			

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[a]1 = primary manufacturing, 2 = secondary manufacturing, 3 = tool maintenance

TABLE 16.25: Concentrations with Major Middle Woodland Components

	Deposit/Activity Types						
	Primary Deposits		Secondary Deposits		Lithic Activities[a]		
Conc.	Limited Activities	Wide Range of Activities	Shell Midden	General Midden	1	2	3
308.41	*				*	*	*
.42[b]				*		*	
.43		*			*		
.71[b]				*	*	*	
274.12				*	*	*	*
341.21[b]				*	*	*	
288.54[b]	*					*	*
390.33				*		*	*
374.11	*					*	
N = 9	3 (33%)	1 (11%)	- -	5 (56%)			

---

[a] 1 = primary manufacturing, 2 = secondary manufacturing, 3 = tool maintenance

[b] - substantial Late Woodland component also in 308.42
- 308.71 and 341.21 defined as late MW - early LW
- 288.54 defined as EW or MW

TABLE 16.26: Concentrations with Primary Components from the Late Woodland

	Deposit/Activity Types						
	Primary Deposits		Secondary Deposits		Lithic Activities[a]		
Conc.	Limited Activities	Wide Range of Activities	Shell Midden	General Midden	1	2	3
308.11				*	*	*	*
.14				*		*	*
.21				*	*	*	*
.22			*		*	*	
.24	*				*		
.31	*				*		
.33				*	*	*	*
.34		*			*		
.51		*			*	*	*
323.21		*			*	*	*
.22				*		*	*
.23		*				*	
.24	*					*	*
341.22		*			no high scores		
.23				*	*	*	*
.24				*	*	*	*
288.22		*					*
.31				*		*	*
.42			*		*		
.45			*			*	*
.52				*	*	*	*
.53				*	*	*	*
374.21		*			*	*	*
.43	*					*	
.44	*				*	*	
.45	*					*	
.46	*					*	
.51	*					*	
.54	*				*	*	
	---	---	---	---			
N = 29	9 (32%)	7 (25%)	3 (10%)	10 (34%)			

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[a]1 = primary manufacturing, 2 = secondary manufacturing, 3 = tool maintenance

components. In addition to these, three buried shell deposits at 19BN308 and one buried hearth feature at 19BN390 were radiocarbon dated to the Late Archaic (Table 16.7). The majority of Late Archaic concentrations (53%) represent primary deposits associated with a wide range of activities (Table 16.24). Only 6% are secondary deposits, although this does not count the four subplowzone components at 19BN308 and 390. Both of the middens listed on Table 16.24 were designated as Late Archaic on the basis of relatively high percentages of quartz artifacts. As mentioned above, this is a less certain technique than are C-14 or large numbers of diagnostic artifacts. Both of the listed middens probably have other pehistoric components in addition to the Late Archaic. Too little is known about the three shell deposits in 19BN308 to infer the deposit/activity types that they represent. The two in 308.33 and 308.42 are part of the base level of thick, dense general middens, but whether the Late Archaic levels themselves have the diversity of a general midden deposit is not known at present.

The overall pattern regarding deposits and activity types suggests relatively short duration Late Archaic settlements that did not involve the genesis of any substantial organic remains in a midden deposit. The question of whether such deposits did once exist, but have completely decomposed, was addressed specifically regarding 19BN281 in an earlier section of this chapter. In the case of 19BN281, the interpretation was that midden deposits never had existed there.

There are Late Archaic middens, to some extent at 288.41 and 390.34, and the base levels of middens in 308.33 and .42. The main pattern, however, seems to have involved movement among a series of locations that probably were reoccupied regularly. A few of these locations were occupied long enough, or by a sufficiently large group, to generate midden deposits.

Regarding lithic activities, neither the types of activities and combinations nor the percentages of occurrence in Late Archaic concentrations seem unusual (Table 16.27). There do not appear to have been any special characteristics or combinations of lithic activities that set off the Late Archaic from subsequent periods.

Late Archaic concentrations are the most frequent of all concentrations that have been dated. Their spatial distribution within the study area is wide (Table 16.28). They occur in the three most densely occupied portions of Nauset. It is at High Head, however, that they occur most frequently.

Early and Middle Woodland

This group of concentrations is the least consistent in terms of chronological interpretations. Unmixed, well-supported (i.e., by C-14 dates or certain diagnostics) Middle Woodland

TABLE 16.27: Lithic Actvities by Temporal Period

Activities	Late Archaic		Middle Woodland		Late Woodland	
Primary Manufacturing (PM)	4	11%	2	22%	4	14%
Secondary Manufacturing (SM)	1	3%	1	11%	4	14%
Tool Maintenance (TM)	--	--	--	--	2	7%
PM and SM	5	14%	2	22%	3	10%
PM and TM	--	--	--	--	--	--
SM and TM	22	59%	2	22%	6	21%
PM and SM and TM	5	14%	2	22%	9	31%
	37		9		28	

TABLE 16.28: Deposit/Activity Types According to Area and Time Period

Area	Late Archiac Deposits/Activities[a]				Middle Woodland Deposits/Activities				Late Woodland Deposits/Activities			
	A	B	C	D	A	B	C	D	A	B	C	D
Fort Hill	-	-	3[b]	-	1	1	-	2	3	4	1	5
South Side of Salt Pond	1	1	-	-	-	-	-	2	-	1	-	2
North Side of Salt Pond	6	1	1	1	1	-	-	1	-	1	2	3
North Shore of Nauset Marsh	-	-	-	-	-	-	-	-	-	-	-	-
Coast Guard Beach	-	-	-	-	1	-	-	-	6	1	-	-
High Head	9	18	-	-	-	-	-	-	-	-	-	-
	Total =41				Total = 9				Total = 29			

[a] A = primary deposit, limited activities; B = primary deposit, wide range of activities; C = secondary deposit, shell midden; D = secondary deposit, general midden.

[b] 3 subplowzone shell deposits C-14 dated to LA: 308.00, 308.33, 308.42 (Table 16.7).

components are rare among this set of concentrations. Not as rare as Early Woodland components, however. There are no strong candidates for Early Woodland components, even as secondary components (Table 16.9). There area few instances of projectile point or ceramic types that are traditionally regarded as diagnostic for this period (e.g., see Table 16.8). It is far and away the most poorly represented period, although some of the characteristics of the Middle Woodland probably also apply to the Early Woodland. Early Woodland traces tend to occur much more frequently among concentrations that also include Middle Woodland materials.

Only nine concentrations were included in this group; however, over half of these include general midden deposits. Association with this kind of deposit suggests a more settled way of life than was suggested by the prevalent deposit/activity types for the Late Archaic concentrations.

The prevalence of general midden deposits and the absence of widespread primary deposits suggests that activities were spatially more consolidated during the Middle Woodland period than previously. This probably meant that activities also were integrated more. The pattern of lithic activities (Table 16.27) is not very illuminating on this point. The small size of the Middle Woodland sample makes its use for detailed comparisons or interpretations risky.

In sharp contrast to the Late Archaic concentrations, the Middle Woodland ones seem to have a much more restricted geographical distribution (Table 16.28). All except one of the concentrations analyzed here occur between Fort Hill and the northern side of Salt Pond. The concentration at Coast Guard Beach is very small. There seem to be additional Middle Woodland components that were not included in this analysis because their assemblages are incompletely processed. At one site (19BN471) discovered on the Herring River in Wellfleet and examined in 1982, about 200 g of pottery was found. The technical and decorative characteristics of the pottery suggest an Early to early Middle Woodland component (see Chapter 14). This interpretation is supported by the discovery of a Lagoon point and a Rossville point, along with a Fox Creek point, at the site also (see Chapter 8). The High Head area also includes some Middle Woodland remains in another site that was discovered and examined in 1982, but is not yet available for study. An Early and/or Middle Woodland component is suggested by a cord-marked, grit-tempered vessel lot, as well as by the use of dentate, rocker-stamping and incising for decoration (see Chapter 14). The site containing this material is located in a portion of Sample Units 197 and 199, shown in the northern portion of Foldout Map L.

Late Woodland

Twenty-nine concentrations were designated Late Woodland. The percentages of deposit/activity types among them are more evenly distributed than for either of the earlier periods. The percentage of secondary deposits from Late Woodland concentrations is of the same order of magnitude as for the Middle Woodland middens.

For the kinds and combinations of lithic activities, the Late Woodland percentages are mainly similar to those of the Middle Woodland. The Late Woodland lithic activities involved quite a bit more independence among the three general activities than did those of the Late Archaic (Table 16.27). Over twice as frequently as Late Archaic concnetrations, Late Woodland concentrations reflect individual lithic activities rather than some combination (14% vs. 35%, respectively).

The prehistoric activities that occurred in 19BN374 are the proximate cause of this pattern. Most of the 19BN374 concentrations represent lithic manufacturing activities and little else. This kind of activity is understandable in an area close to an actively eroding marine scarp where new lithic raw material in the form of cobbles would have been easy to procure. This individual instance might be a clue to greater differentiation among activities, or a different way in which activities were accomplished, perhaps even the development of task specialization during the Late Woodland.

Aside from the greater numbers in general and the possibility of more special purpose locations, interpretations of the percentages of the various deposit/activity types are similar to those made about the Middle Woodland. A variety of activities from food processing to tool manufacture and maintenance often were conducted in the same or nearby portions of a settlement and deposited in a common area. This continued spatial consolidation of activities in a way is contradicted by the use of a special purpose site to process blanks or preforms for lithic tools, as inferred at 19BN374. On the other hand, the occurrence of both these arrangements of activities may simply demonstrate a flexibility in activity arrangements and organization during the Late Woodland.

The geographical distribution of Late Woodland concentrations is similar to the Middle Woodland distribution. Except for the lithic manufacturing activities at 19BN374, concentrations are located between Fort Hill and just north of Salt Pond. Table 16.28 shows no Late Woodland concentrations in the High Head area. This is true for the survey data; however, several excavations in the area prior to the establishment of the National Seashore identified Late Woodland components, albeit small ones (Moffett 1957, 1962).

The statewide archeological collections inventory of the Massachusetts Historical Commission studied several large and well-documented collections from the outer Cape. Their analysis identified a pattern similar to the one inferred from the survey data:

> the sites on High Head in north Truro have a very thin scatter of Late Woodland material. Major Late Archaic sites [on High Head] produced only a dozen Levanna triangles in total. Moffett remarks on the scarcity of pottery and [Levanna] points at the high Head sites...thus it would appear that High Head was a major focus of prehistoric activity in the Late Archaic and the early part of the Woodland. However by Late Woodland times, it is relatively unimportant (Massachusetts Historical Commission 1981:14-15).

Temporal Variation in Economic Activities

Current interpretations deal with variation in economic activities over time only generally. It is commonly held, for example, that horticulture gradually became an increasingly important economic activity in southern New England. Likewise, it is inferred that the frequency and importance of shellfish gathering varied temporally. There is little or no consideration in current interpretations about the integration of activities (see Chapter 5).

Similar lithic manufacturing and maintenance activities and subsistence actvities occurred throughout the time periods analyzed here. There doesn't seem to have been much difference among the time periods in the relative frequencies of the three kinds of lithic activities identified for this analysis (Table 16.27). This temporal similarity is at odds with the temporal variation in projectile points that is so commonly noted among Northeastern archeologists.

A similar comparison of possible differences in subsistence activities was possible for four concentrations from the Middle and five from the Late Woodland (Table 16.29). As with the lithic activities, no large differences are immediately apparent. The orders of magnitude and variation among scores in all of the categories are quite similar. Additional more detailed analysis of remains associated with the specific levels dated to the Late Archaic in 19BN308.33 and .42 will permit the comparison of Late Archaic remains as well, but these data are not available at present.

Given the general level of analysis of economic activities that has been possible with the survey data so far, it is premature to state flatly that the types and relative frequencies of activities did not vary during prehistory. The incorporation of horticultural activities aside, it would be surprising if the variations in activity integration, scheduling and spatial

TABLE 16.29: Comparison of Subsistence Remains[a]

Time Period	Conc.	% of Resource by Weight B	F	M	O	U	T	Weights CS	CN
Hand Excavation									
LW	308.21	.3	7	74	8	10	32.5 g	--	--
LW	308.33	6	10	59	9	17	111.0 g	--	--
LW	341.23	4	2	85	3	7	219.0 g	--	--
LW	341.24	4	9	61	5	21	267.6 g	--	2.84
LW	288.31	--	--	--	--	.4	.4 g	.6[b]	--
MW	308.42	3	.9	60	29	9	512.1 g	--	.07
MW	308.71	4	6	34	53	3	256.5 g	--	--
MW	274.12	4	.1	84	--	12	102.6 g	--	--
MW	341.21	6	8	77	2	7	665.8 g	--	.35
Flotation									
LW	308.21	--	5	--	41	54	4.1 g	tr	--
LW	308.33	.2	11	54	10	25	56.3 g	.4	tr
LW	341.23	--	9	51	--	41	8.1 g	.02	--
LW	341.24	1	74	16	1	7	178.9 g	.7	.06
LW	288.31	no flotation samples							
MW	308.42	3	1	15	2	79	42.5 g	.01	--
MW	308.71	1	66	3	23	8	81.8 g	.47	tr
MW	274.12	17	31	--	--	52	4.2 g	.05	tr
MW	341.21	2	7	60	--	31	8.4 g	.09	.44

[a] Data from Chapter 10 ; key: B = bird; F = fish; M = mammal; O = other; U = unidentified; T = total fauna weight (in grams); CS = carbonized seeds (in grams); CN = carbonized nuts (in grams); tr = trace only; total percent

organization were not associated with significant changes in the activities themselves. More detailed analysis of the lithic, faunal and floral assemblages following this line of inquiry should be very fruitful.

The organization of activities does seem to shift between the Late Archaic and Middle Woodland periods. For the latter, and the Late Woodland also, a larger percentage of lithic manufacturing actvities were done alone (Table 16.27). Secondary manufacturing, in particular, was more frequently spatially distinct during the later time periods. The spatial separation of lithic activities is most pronounced in the Late Woodland when 35% of the concentrations have a single predominant lithic activity (compared to 33% for the Middle Woodland and 14% for the Late Archaic). At the same time the Late Woodland had the largest percentage (31% vs. 22% for the Middle Woodland and 14% for the Late Archaic) of concentrations with all of the lithic actvities represented. The temporal variation in the organization of lithic manufacturing activities may represent different settlement situations faced by the Late Archaic and the Woodland stone workers. The latter may have operated out of permanent settlements (see below) and have been able to plan more regular and separate procurement, manufacturing and maintenance activities. There may have been an advantage in efficiency or effectiveness for Late Woodland stone workers to segment the lithic manufacturing process into separate activities. Such an option for planning may have been less available to Late Archaic individuals who probably moved more frequently and for reasons unrelated to lithic procurement, manufacturing or maintenance.

Temporal Variation in Spatial Organization

There has been a fair amount of description and analysis of spatial organization in the specific form of settlement pattern studies. The current interpretations note a trend towards sedentary occupations during the Woodland period, although it is inferred that substantial amounts of activities continued to take place at special purpose work stations or camps (e.g., Cronon 1983:34-53; Snow 1980:75-79). Ritchie (1969:vii-viii) has suggested that sedentary settlements may have existed in coastal areas from the Late Archaic onward because of the relatively abundant and diverse subsistence resource base available there, a position supported in two recent essays as well (Perlman 1980; Yesner 1980). In addition, current analysis of data from the Maine coast suggests multiseasonal or year-round occupation of many sites (Spiess, et al. 1983; Spiess and Hedden 1983:181-183).

Late Archaic concentrations have far fewer midden deposits than concentrations from the later periods. Some Late Archaic middens may have been inundated, like the shell layer discovered at 19BN308.00, so they probably were more abundant than the available data reflect (Salwen 1965). On the other hand, Late Archaic primary deposits were found more consistently in a

greater variety of locations than later period concentrations.

The Late Archaic concentrations seem to represent less intense or shorter-term occupations, but they occur throughout the Nauset area, and nearly exclusively in the High Head area. At Nauset, they are consistently less substantial in the Fort Hill and Salt Pond areas than the Middle and Late Woodland concentrations that cluster in these locations. This consistent association with a wide variety of environments is in keeping with the interpretations of Salwen (1965:159-176) and Dincauze (1974) that the Late Archaic adaptation involved periodic movement among a variety of microenvironments to exploit different subsistence resources.

This interpretation runs counter to Ritchie's (1969:vii-viii) suggestion of Late Archaic sedentary settlements in coastal environments. On the other hand, the shell layers in the Fort Hill area that have been dated to the Late Archaic (in Concentrations 308.00, .33, and .42) may indicate some midden accumulation from year-round activities similar to several of Ritchie's Late Archaic components on Martha's Vineyard. Further analysis of the faunal assemblages from the Fort Hill Late Archaic components may answer this question. The truth of the matter may turn out to be that coastal Late Archaic populations were semi-sedentary, with some of the population residing year-round in areas like Nauset or the ponds on Martha's Vineyard while others moved about among a series of locations exploiting various resources. Membership in the mobile and the sedentary portions of populations need not have been fixed. Such a settlement system would have been similar to the one inferred for the Moorehead phase (ca. 4500-3700 B.P.) populations in coastal Maine. Spiess, et al. (1983:97) suggest that during the Moorehead phase

> settlements were probably divided between relatively permanent coastal multiseasonal villages and relatively transient interior and offshore sites situated for advantageous access to special resources.

The characteristics and spatial distribution of Middle Woodland concentrations indicate a substantial change from the Late Archaic pattern. During the Middle Woodland, large, dense middens appeared in the Fort Hill and Salt Pond parts of the Nauset area along with primary deposits, a few of which were found in other parts of the Nauset area. The Late Woodland concentrations cover the same area as those of the Middle Woodland and are over three times as frequent. The pattern of deposit/activity type distribution is very similar for the two periods with that of the Late Woodland much more intensive.

Except for the occurrence of a single Middle Woodland projectile point in Concentration 282.41 at High Head, Middle and Late Woodland components outside of Nauset are not represented in

the data set being analyzed here. The actual case is that some Middle and Late Woodland components have been found at or near High Head, by avocational archeologists prior to creation of the National Seashore (Moffett 1957, 1962; Massachusetts Historical Commission 1981). In addition, during the 1982 field season of the survey, sites 19BN471 and 415/481, both of which seem to have Early or Middle Woodland components, were discovered and examined. These sites are located on the Herring River in Wellfleet and at High Head respectively. The characteristics of these newly discovered sites and of the previously excavated ones indicate that the Middle and Late Woodland components are frequently associated with midden-like deposits. This suggests that at High Head, components of the later periods probably represent a different intensity or duration of activities than the Late Archaic components there.

The density and diversity of remains in many of the Middle and Late Woodland components suggest that these represent sedentary, relatively long-term occupations. As in many of the middens that Ritchie (1969) excavated, there is a diversity of subsistence remains (see Tables 16.5 and 16.29) that indicate the exploitation of a variety of microenvironments and the processing of subsistence resources at a single base location near the midden. The seasonal organization analysis described earlier in this chapter (see also Chapter 12) showed clearly that the exploitation of shellfish at Nauset occurred at least during the winter throughout the prehistoric period. It is expected that seasonality data from further analysis of fish, bird and plant remains in the prehistoric assemblages will indicate year-round subsistence activities at Nauset.

Sedentary settlements at Nauset surely would have been supplemented by special purpose camps set up in other locations specifically for resource procurement. That archeological sites indicative of these kinds of camps have not been found by the survey indicates that they encompassed very limited activities and were of short duration, thereby generating few archeological remains. The difficulty of discovering such low density, though potentially abundant, sites need not be of concern here (see McManamon 1984). The point is that the absence of a variety of Middle and Late Woodland components with a widespread distribution is negative evidence supporting the interpretation that Nauset was a locus of year-round settlement from at least the Middle Woodland period onward, and that from the Middle Woodland onward exploitation of a variety of resources in different microenvironments on the outer Cape was accomplished from bases like Nauset.

Summary

This chapter has described several dimensions of prehistoric cultural adaptations in a manner analogous to niche analysis in evolutionary ecology as described in Chapter 5. Changes in the

dimensions during the course of prehistory were noted and discussed. Although no explanations of the changes were evaluated sufficiently to confirm or reject them, the causes of specific temporal variations were considered suggestively.

Temporal Variation in Cultural Adaptations

Four shifts in adaptations were identified and described. All of the niche dimensions: seasonal organization, external cultural contact, economic activities, and spatial organization were affected at some point during prehistory. Seasonal organization of shellfish collecting was found to vary between the Late Archaic and Middle Woodland periods and the Late Woodland period. During the former two, shellfish seem to have been collected in the winter, early spring and summer, but by the Late Woodland period the summer collection seems to have been abandoned or at least reduced, perhaps in order to engage more completely in horticulture.

External cultural contact reached an apex during the Middle Woodland, providing that the percentage of exotic lithic materials in concentrations is an accurate measure. The shift from the Late Archaic pattern to the Middle Woodland one was very sharp. The shift between Middle and Late Woodland was merely quantitative. The pattern during the later period was similar but there was less exotic material relatively and absolutely in the later component assemblages. The Late Woodland pattern is also very different from that of the Late Archaic.

Economic activities were broadly similar for each time period, but the Late Woodland lithic manufacturing and maintenance activities seem to have been undertaken independent of each other more frequently than during either of the past periods. This pattern seems to have begun during the Middle Woodland, but there are too few assemblages dated to this period to say this with certainty. The shift might reflect more regularly scheduled manufacturing or maintenance activities that would have been more possible in a sedentary way of life.

The spatial organization of Late Archaic concentrations and that of the Middle and Late Woodland periods reflect very different cultural adaptations. There seems to have been a clear and distinctive shift in the settlement system with year-round settlement as a focus of the spatial organization from the Middle Woodland onward.

The existence of year-round settlements was inferred from the presence of dense midden deposits with a wide variety of remains and the absence of components with diverse primary deposits in a wide variety of microenvironments (i.e., what appears to be the archeological record of the Late Archaic settlement pattern).

An independent source of data that supports the notion of year-round settlement on the outer Cape from at least the Late Woodland onward is the existence of the Indian Neck ossuary in Wellfleet (Bradley et al. 1982). There is ample ethnohistoric information from other parts of the Northeast that ossuary burial patterns were associated with population permanence in an area. Historic period ossuaries among the Huron were a focus for sedentary populations that resided in a number of different villages. One function of the ossuary type of interment seems to have been to reinforce the community, political and personal bonds between people who resided permanently in different locations (Heidenreich 1971:148-151). It is not suggested that the Indian Neck ossuary indicates an earlier version of the historic period Huron resided on the outer Cape. However, the clear association between year-round settlement residence and ossuaries in Huronia suggests that a similar association between a number of year-round settlements on the outer Cape and the Indian Neck ossuary is not unrealistic.

Archeological evidence from Maryland, coastal Virginia and North Carolina indicate a similar association of ossvary burial patterns with settled village life (Phelps 1983:40-43: Ulbelaker 1974).

Links with Current Interpretations

The interpretations of the survey data have an impact on three specific aspects of current interpretations in Northeastern prehistory: shellfish collecting, year-round settlements and settlement of coastal areas.

Shellfish in Northeastern prehistory seem to attract contorversy. In the past disputes have swirled around questions about the genesis of shellfish exploitation, the extent of shellfish exploitation and temporal variation in the shellfish species exploited. This study stays clear of these issues and makes a statement on another related topic. Shellfish collecting was mainly a winter and early spring activity on the outer Cape. The seasonal organization data are rather straightforward regarding this. As discussed above, it runs counter to interpretations that shellfish collecting was mainly a summer activity (Snow 1980:230) or that shellfish were exploited equally during all seasons (Ritchie 1969:vi-viii).

Results of the spatial organization analysis have been interpreted to mean that year-round settlements existed on the outer Cape, specifically at Nauset, but surely also in other locations outside the investigation area boundaries, from at least the Middle Woodland period onward. This is not so much counter to most interpretations as it is a more detailed description of the spatial organization in a specific coastal area. The existence of sedentary settlement in coastal southern New England is acceptable within the context of current

interpretations which unanimously state that throughout the Woodland period year-round settlement became increasingly common. Recently some have argued that diverse and abundant natural foods made it possible even prior to the Woodland (Perlman 1980; Spiess, et al. 1983; Yesner 1980), which, as pointed out above, Ritchie suggested in 1969.

A recent interpretation of late prehistoric and early historic period coastal settlement by Ceci (1979) questioned the existence of any permanent precontact native settlements in coastal New York. More recently she has proposed a similar interpretation for the Northeast coast in general, citing ethnohistoric data from Mallebarre, known today as Nauset Marsh, as support for her new model (Ceci 1982:24-29). The interpretations from the seasonal and spatial organization analyses presented here do not support Ceci's interpretation that intense settlement in the Nauset Marsh area did not occur until European contact. All of the general midden areas for which C-14 dates were obtained indicate substantial Middle and Late Woodland settlement.

Prognosis

Few research projects answer all applicable questions raised, and this project is no exception. This stage of the analysis has raised more questions, but they are questions that are better focused than those we originally had. The new questions get beyond description to explanation of the patterns and shifts in cultural adaptations identified and described in this report.

This analysis has provided the important, even invaluable, service of summarizing the pattern of cultural adaptations using both current interpretations and the survey data analysis. It should serve as a platform from which to identify more specific, more important research questions. It should help as well to identify the means by which to answer these questions, not only for the survey but for others tackling similar topics.

The research reported here has made two methodological advances as well. The concept of ecological niche has been transferred succesfully to provide an explicit, detailed means of describing cultural adaptations. For the prehistory of the study area, the data somewhat limit the description of the seasonal organization and external contact niche dimensions. Nonetheless, the method seems workable and provides results amenable to comparisons.

The problem of identifying units of analysis in disturbed archeological sites also was addressed. A method and techniques that consistently and explicitly identified units of analysis was developed. The units that were identiied are justifiable and comparable. Other methods of considering intrasite analysis can

and may also be applied to the survey data set in order to explore spatial patterns in more detail.

These methodological and technical developments, as well as the substantive ones, will be applied, and improved wherever possible, as the complete Cape Cod data set is incorporated into analysis.

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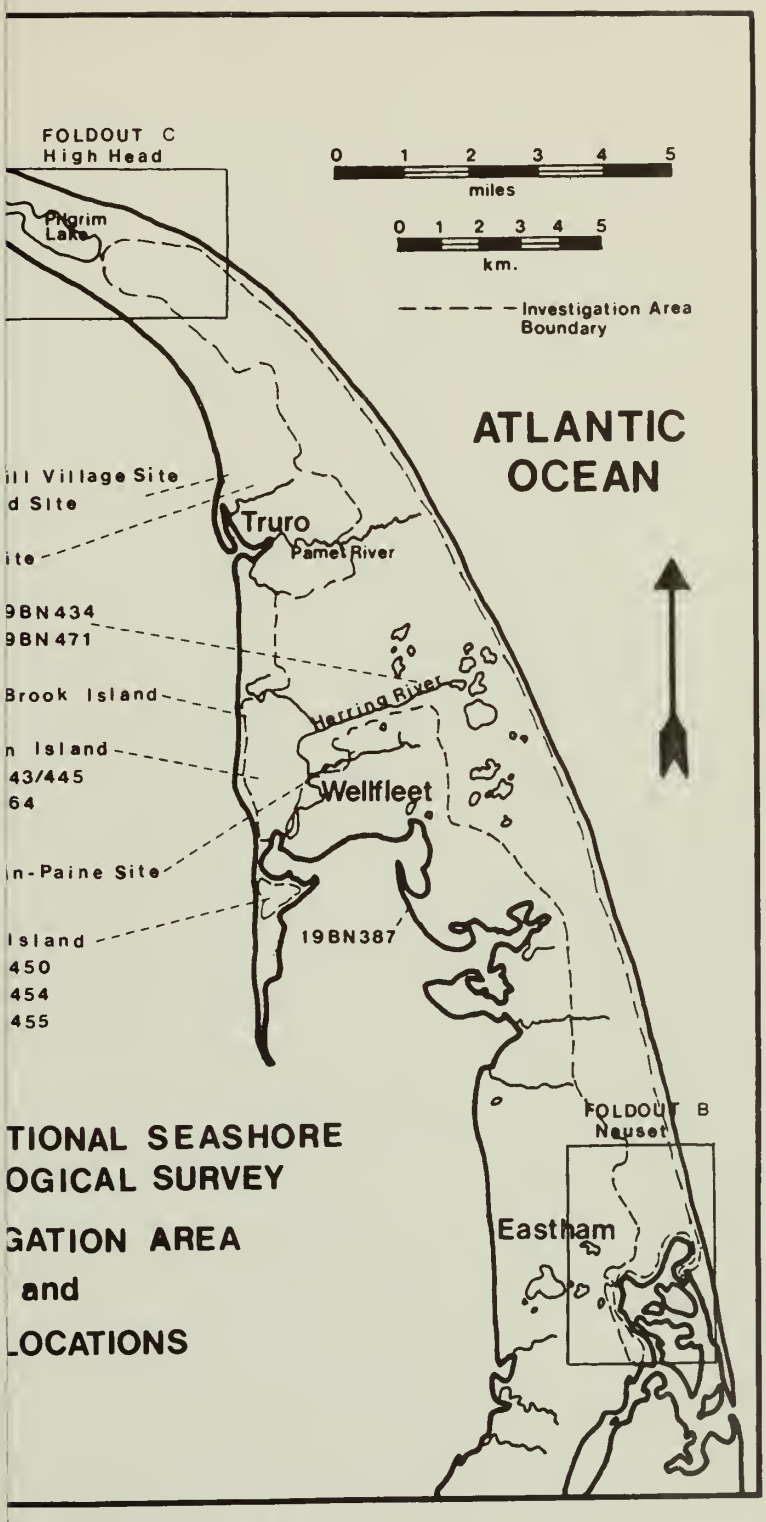
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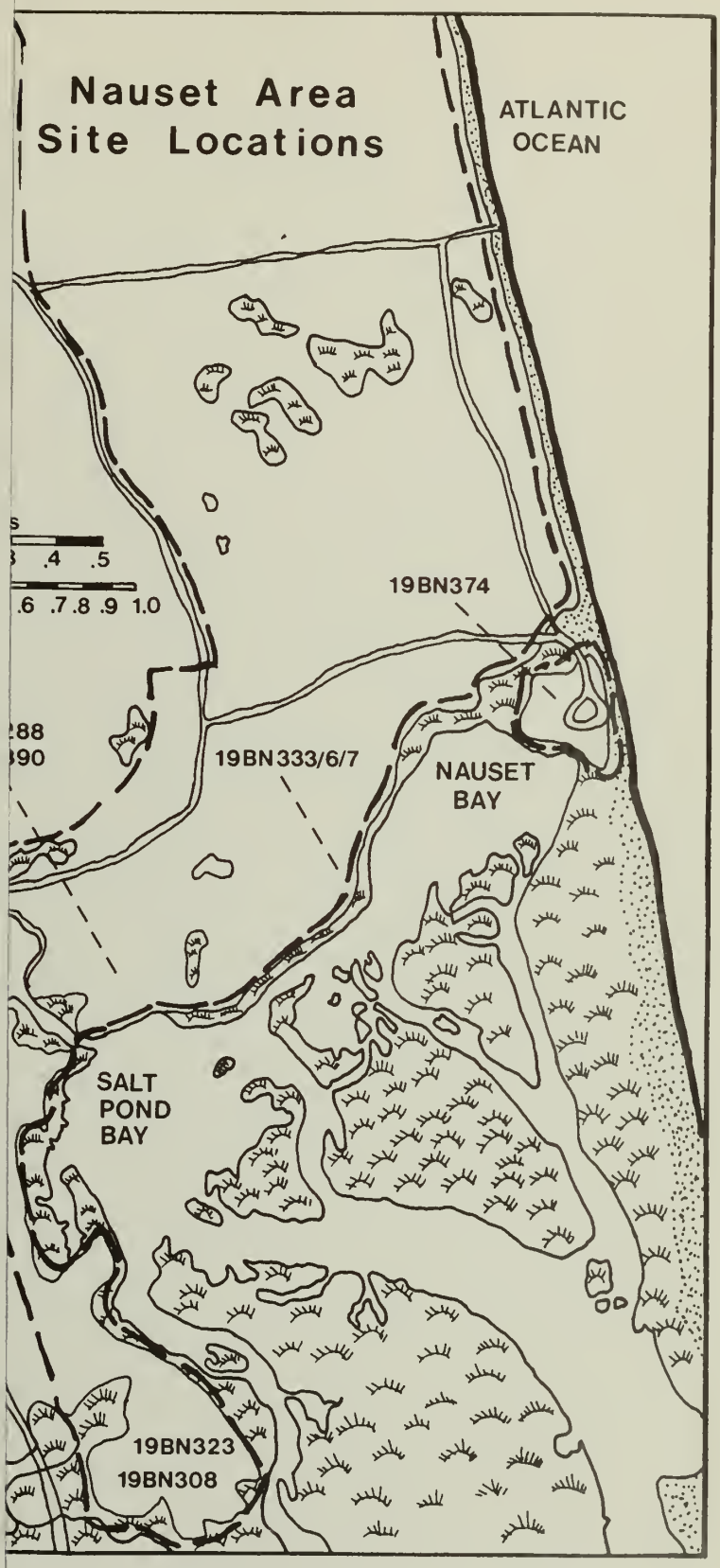
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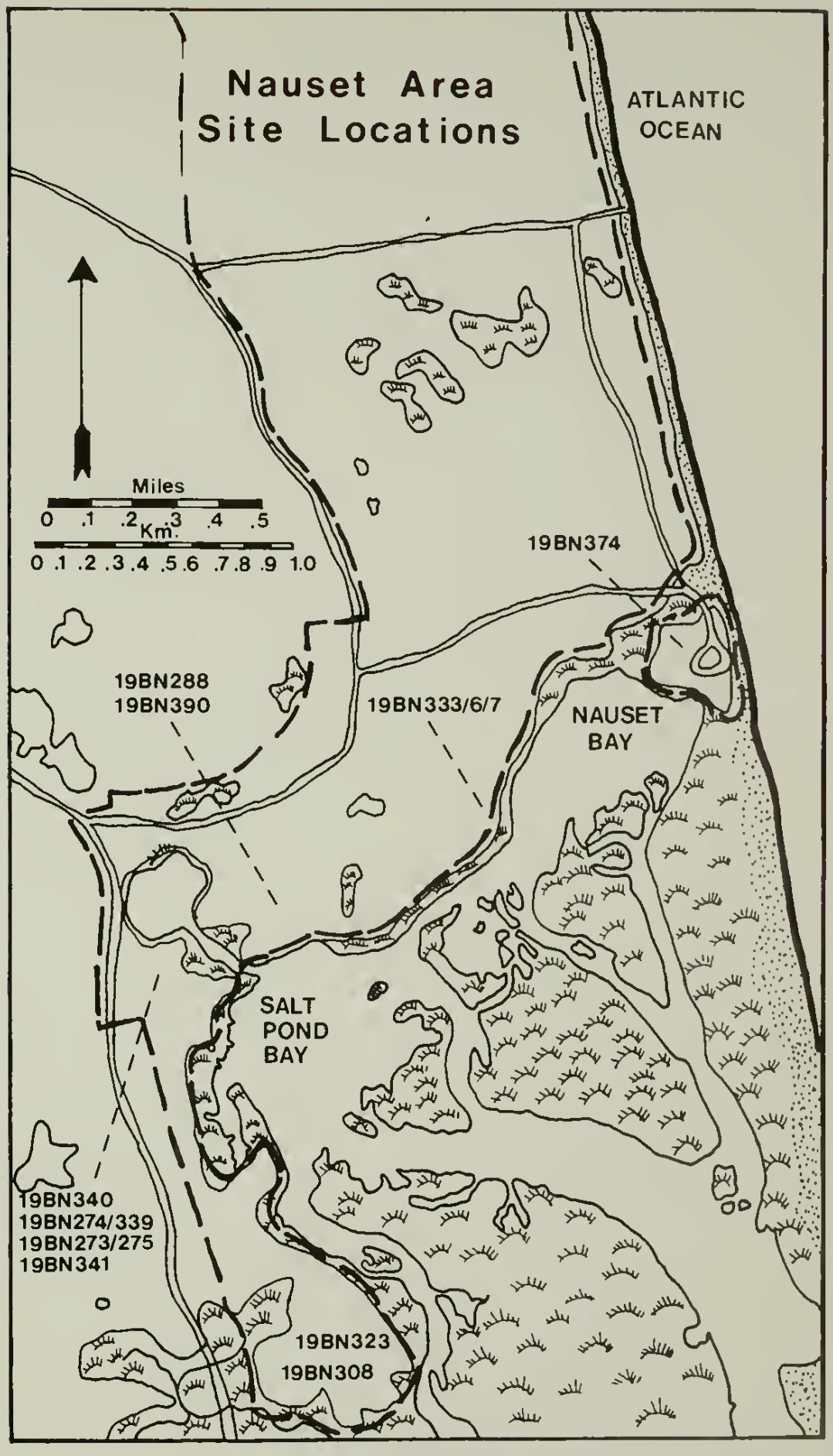
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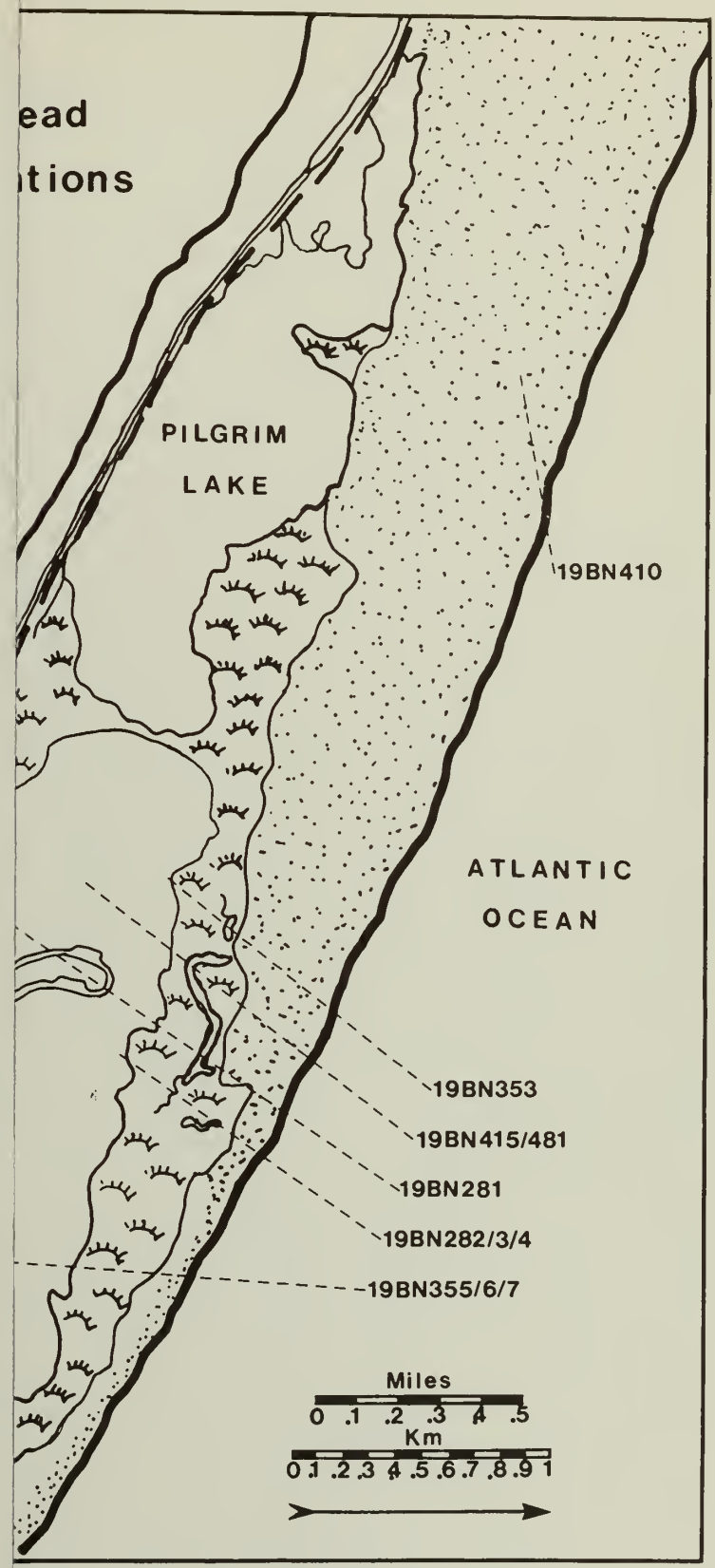
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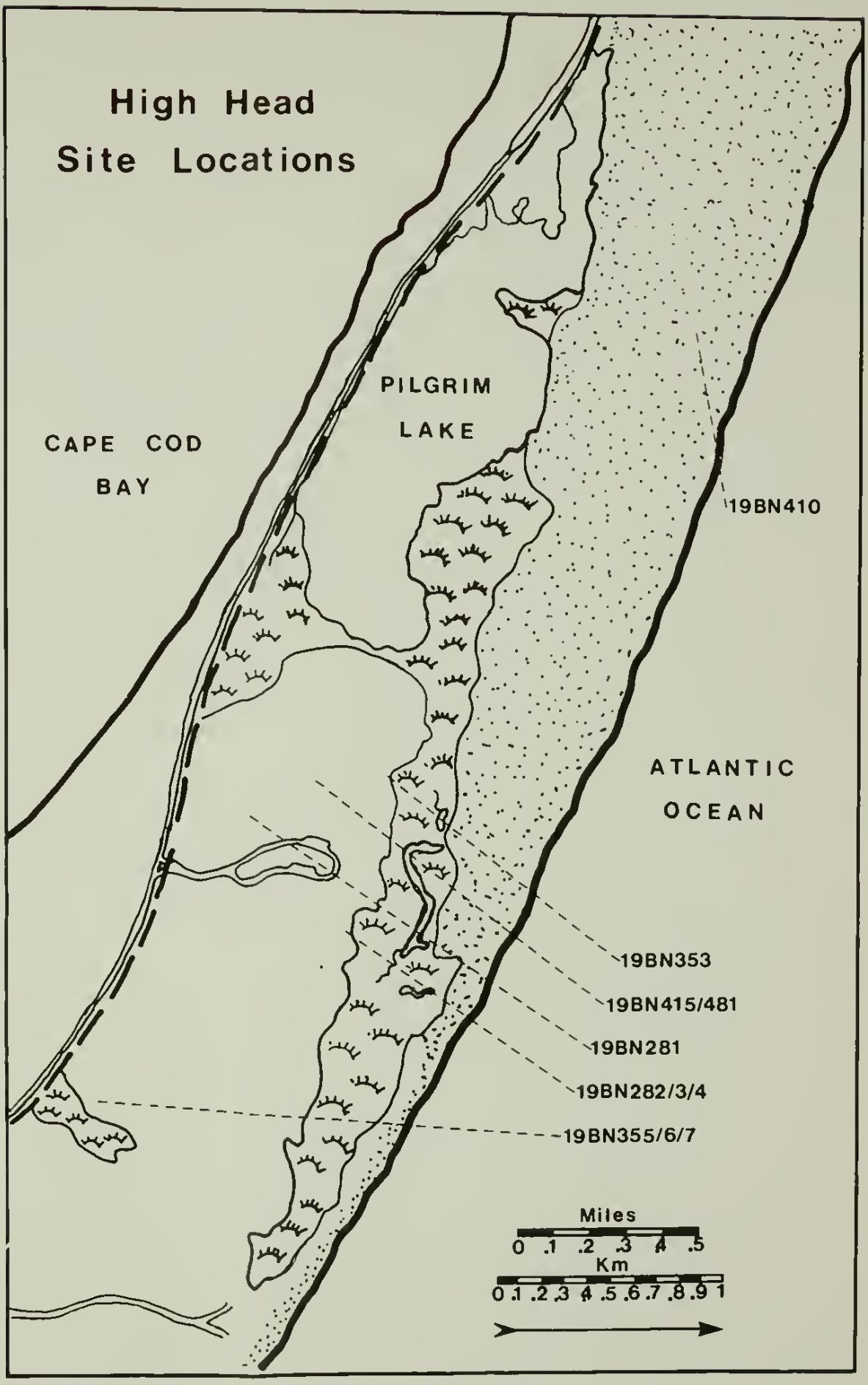
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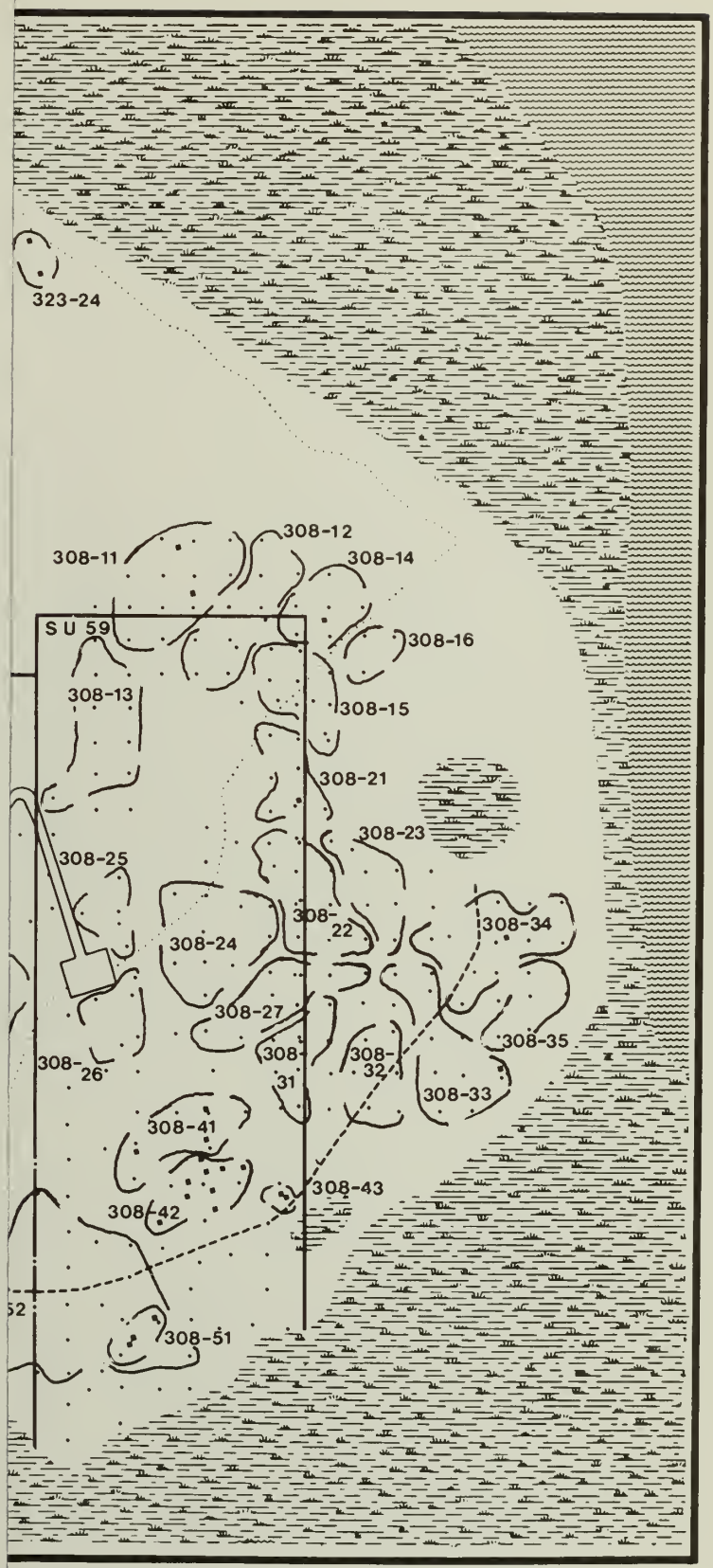
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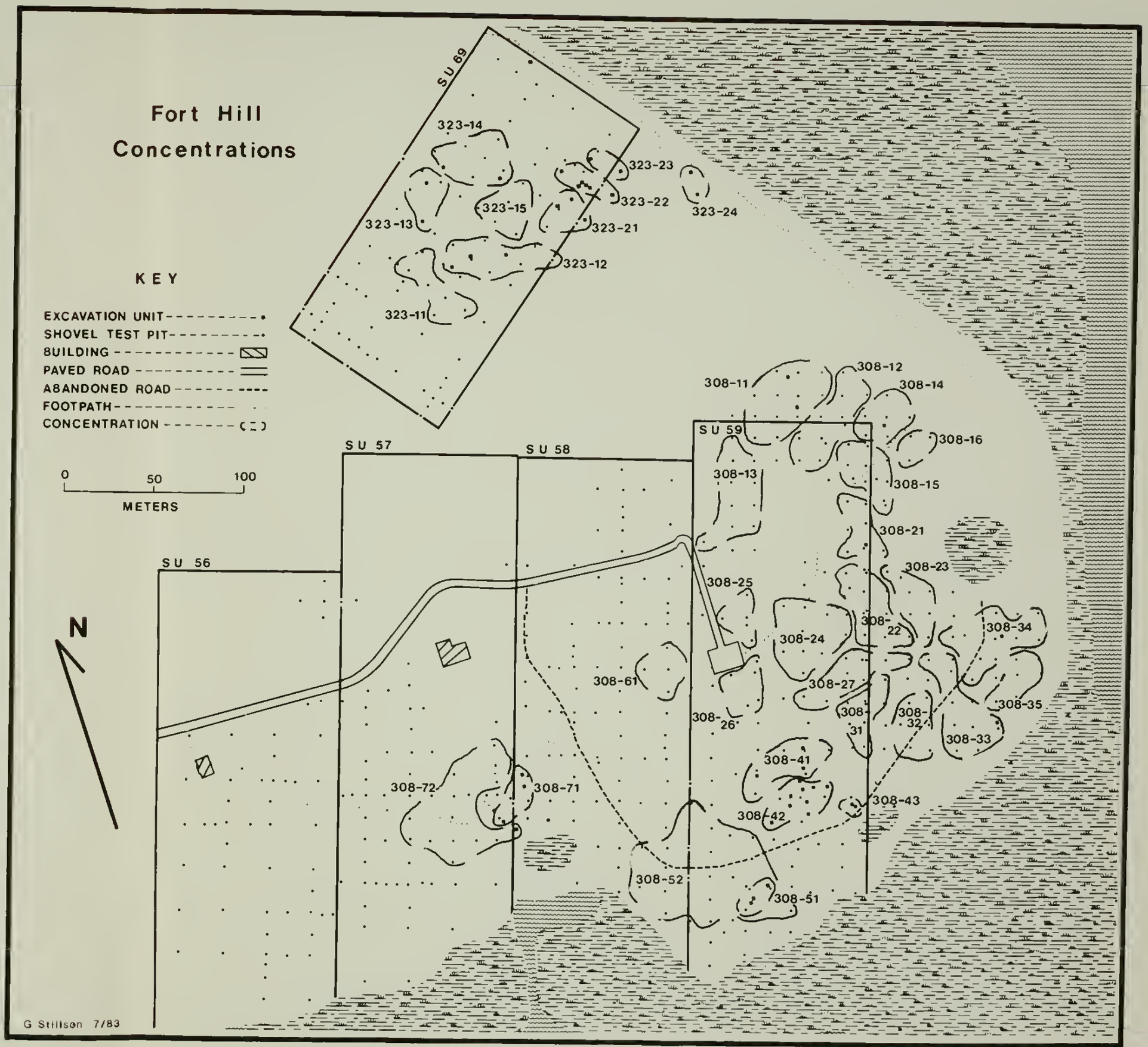
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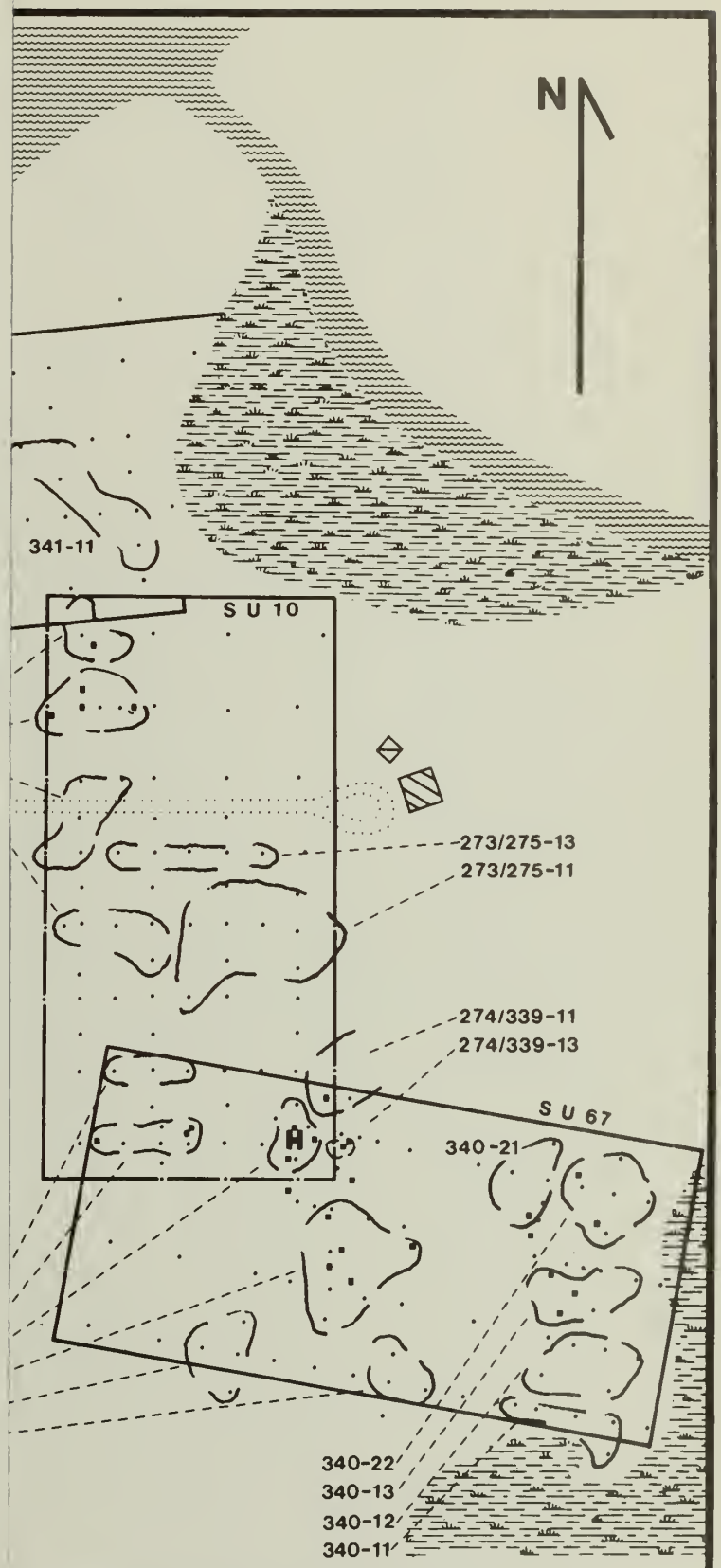

Salt Pond Concentrations

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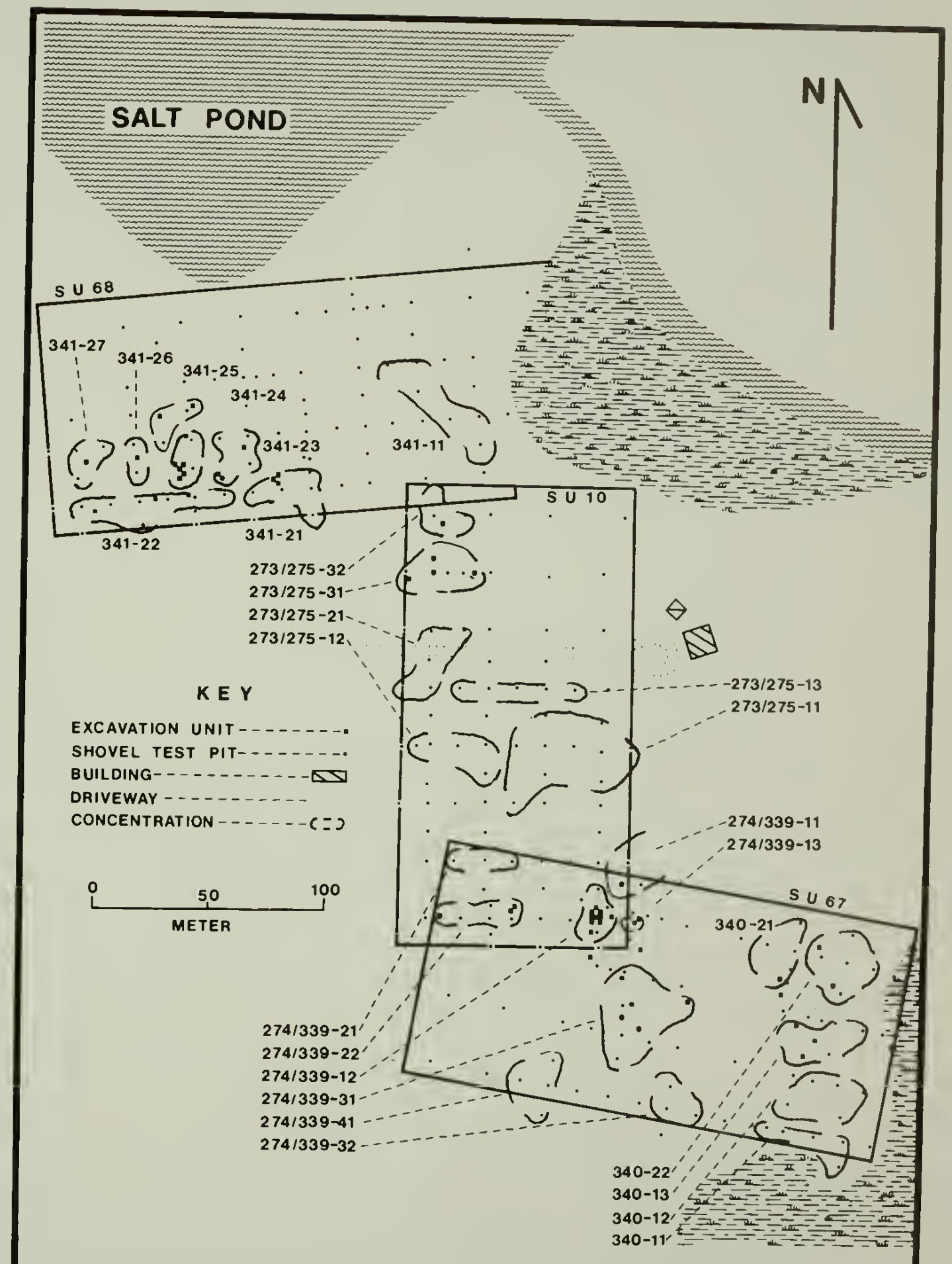

Southern Side of Salt Pond Concentrations

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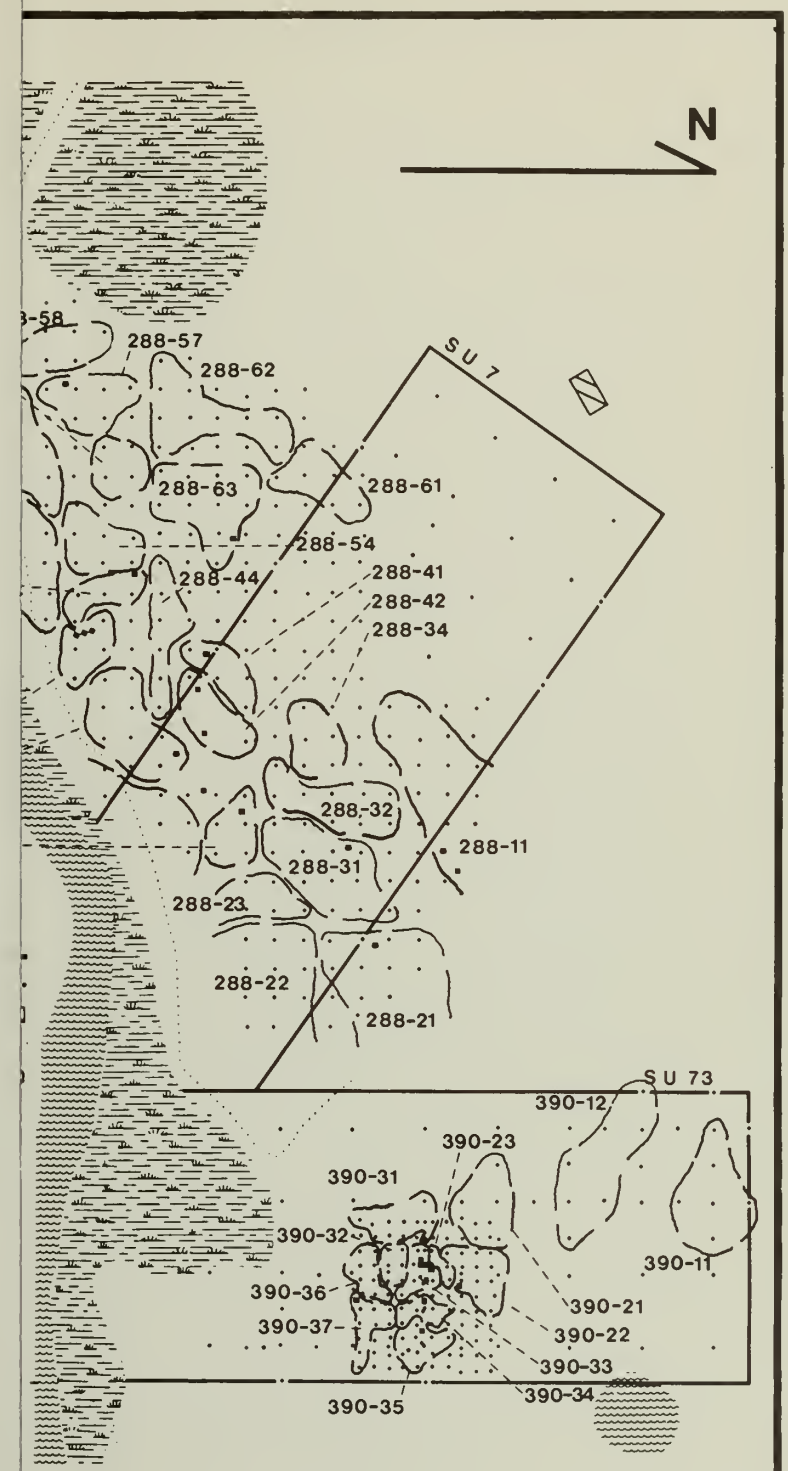

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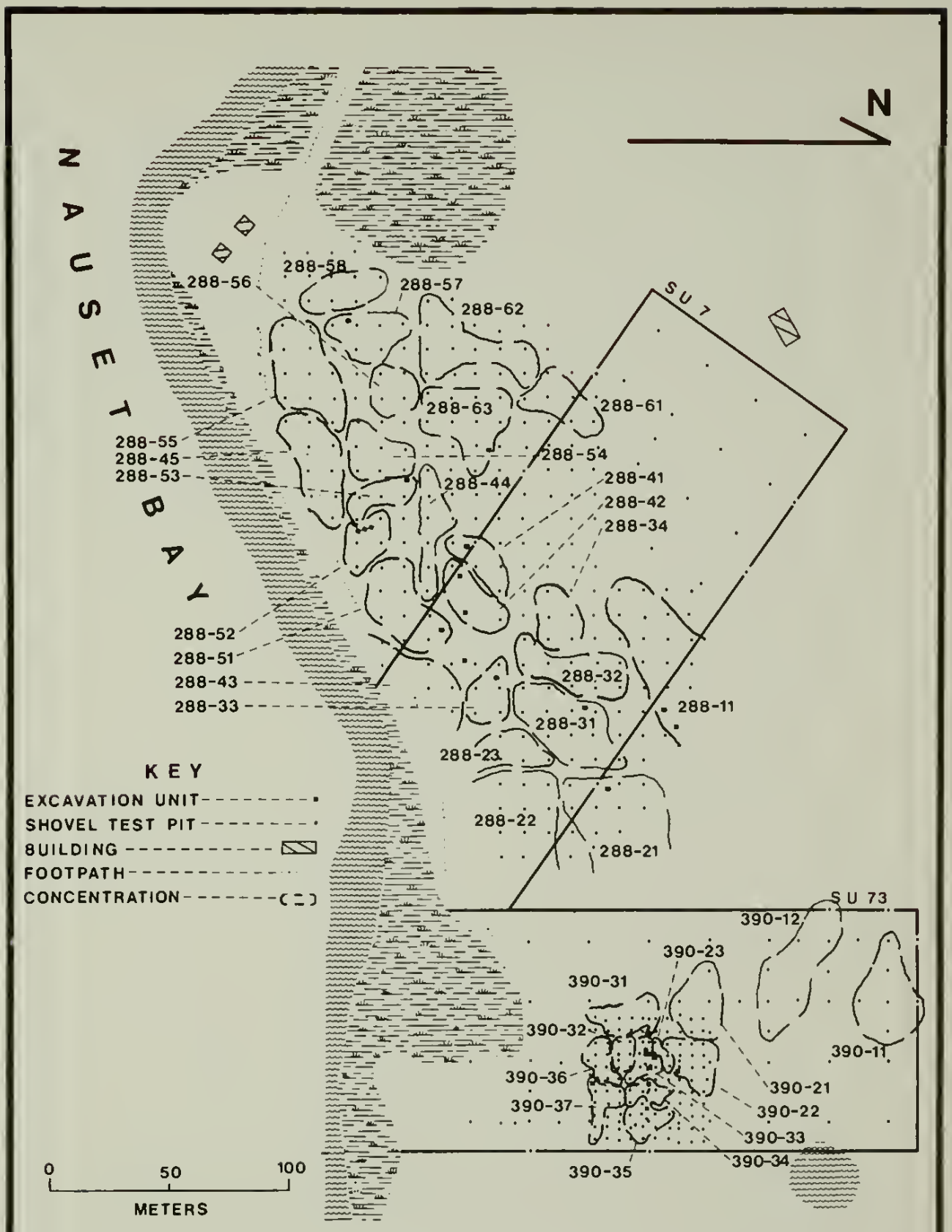

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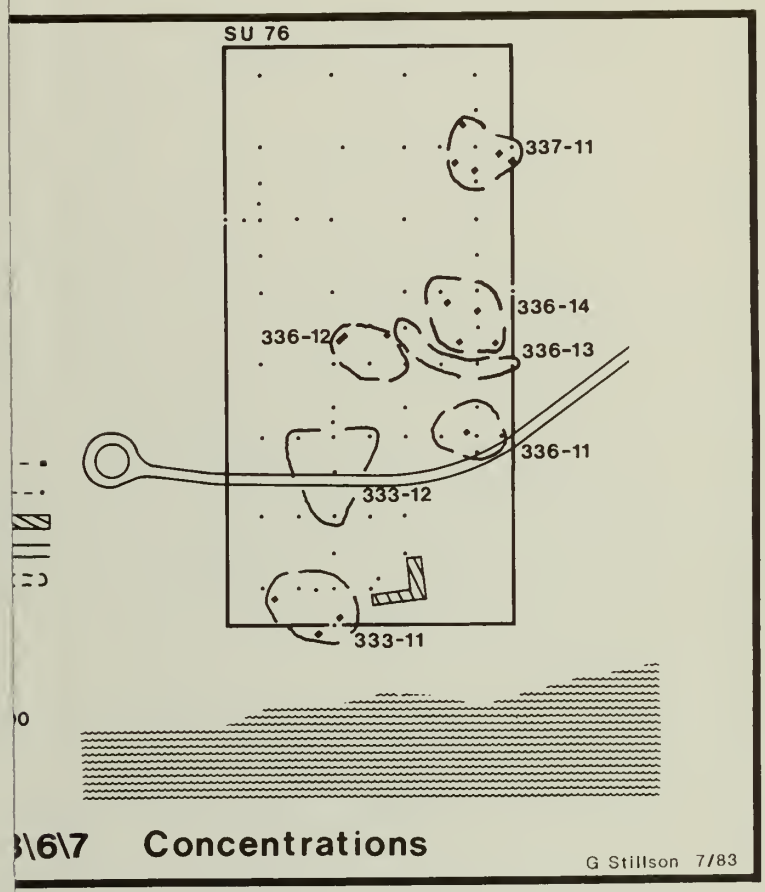
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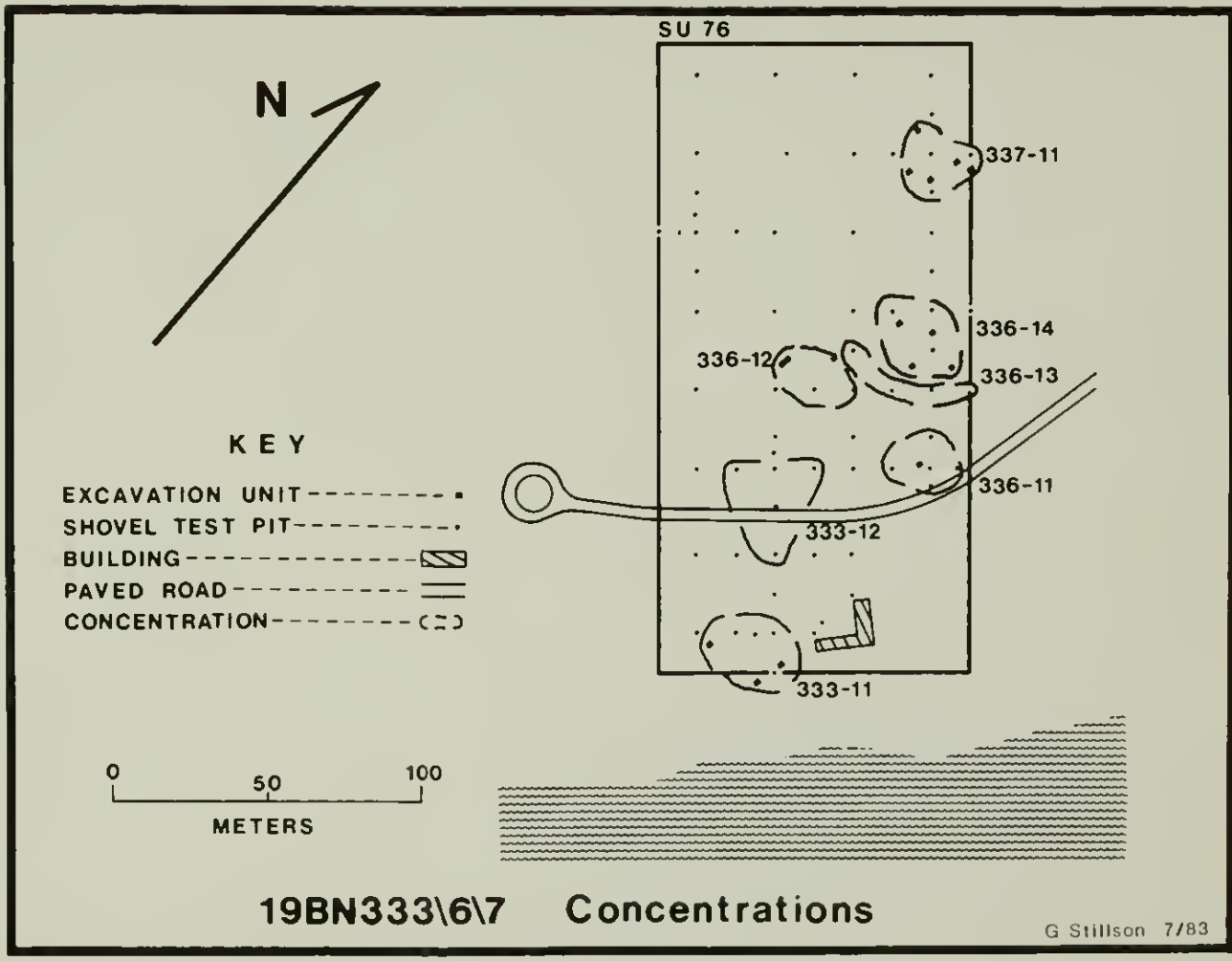
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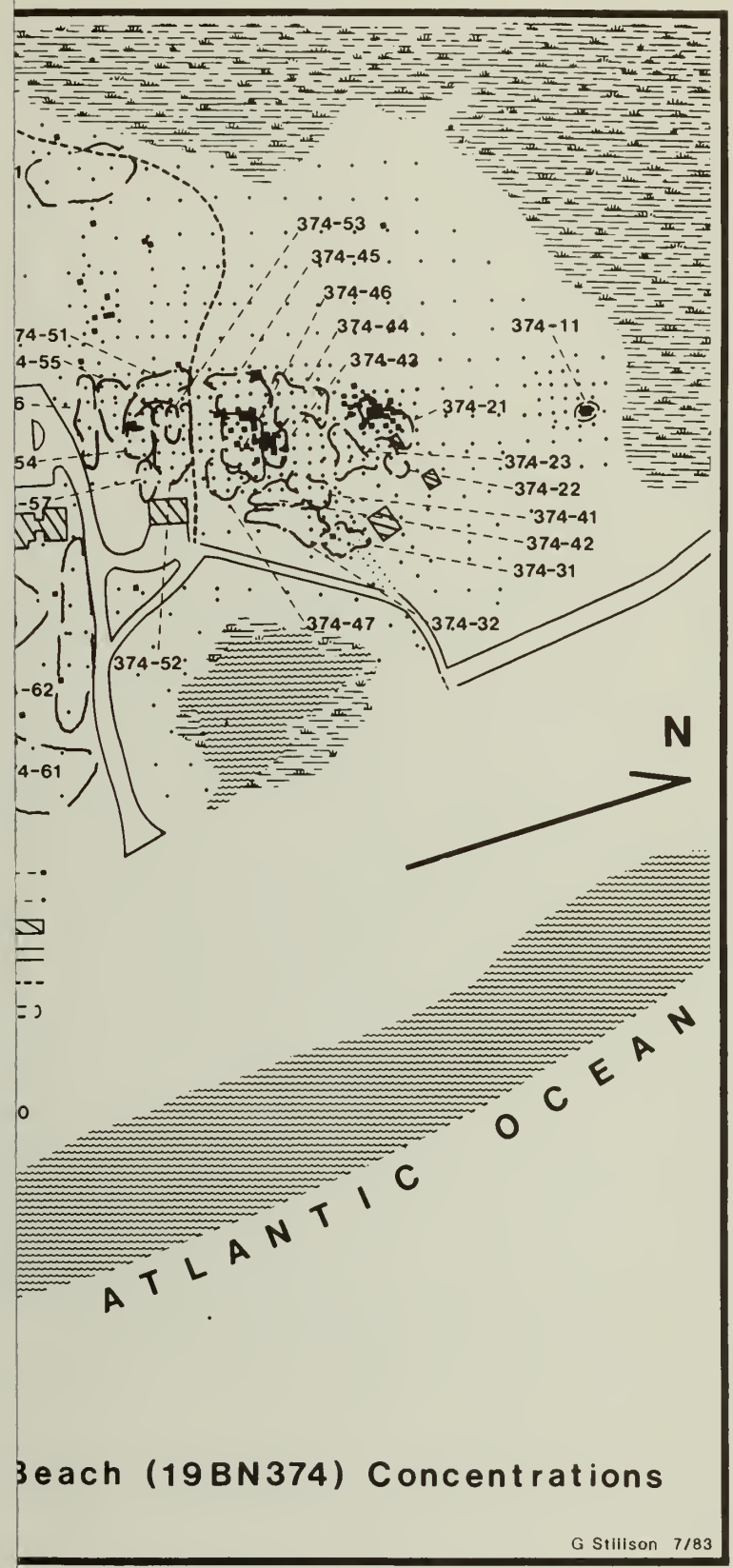
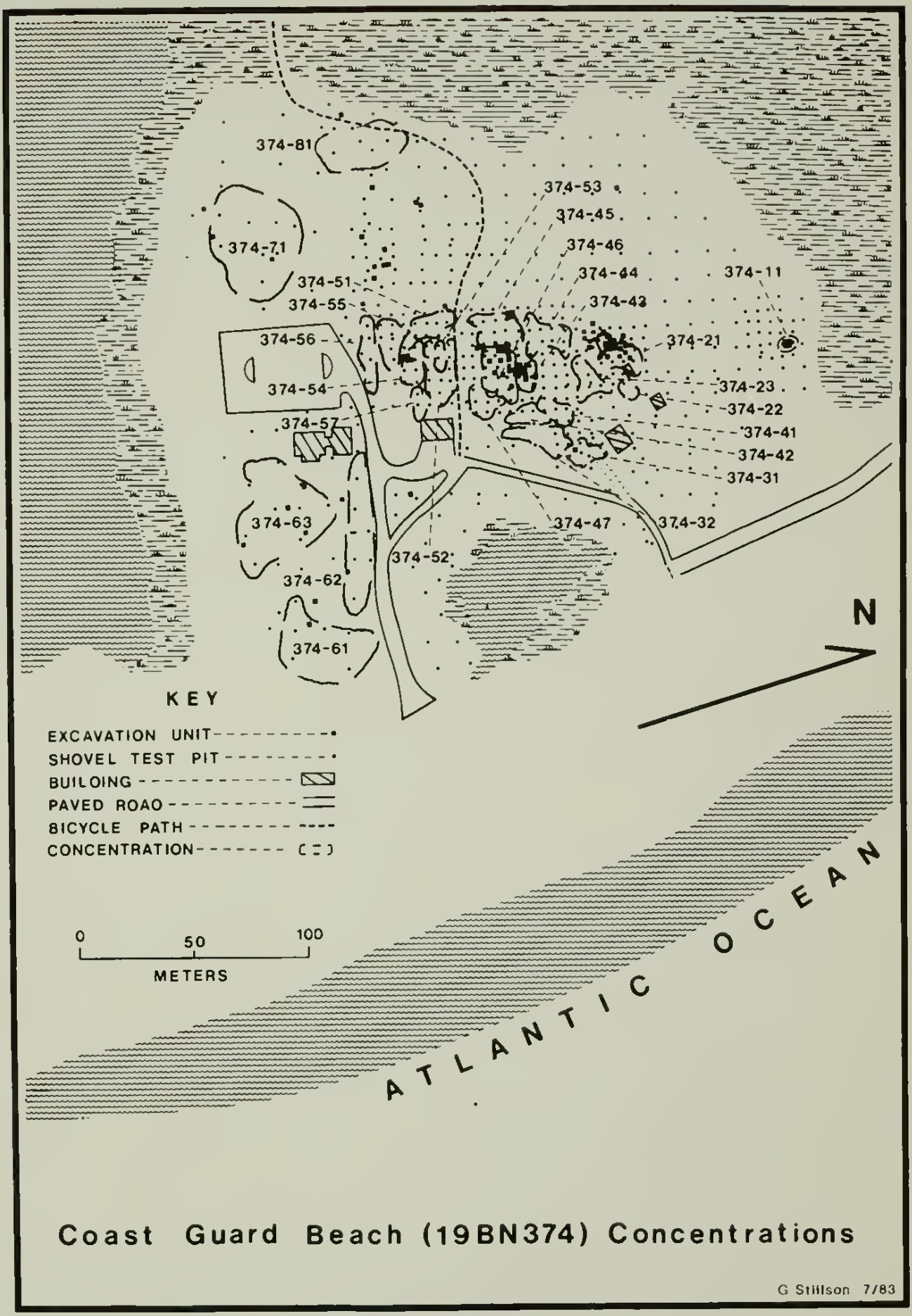
PAVED ROAD
CONCENTRATION
0
50
100
METERS
19BN333\6\7 Concentrations
G Stillson 7/83

FOLDOUT G


374-53
374-45
374-46
374-44
374-11
374-43
374-21
374-23
374-22
374-41
374-42
374-31
374-47
374-32
374-52
N
ATLANTIC OCEAN
Beach (19BN374) Concentrations
G Stillson 7/83

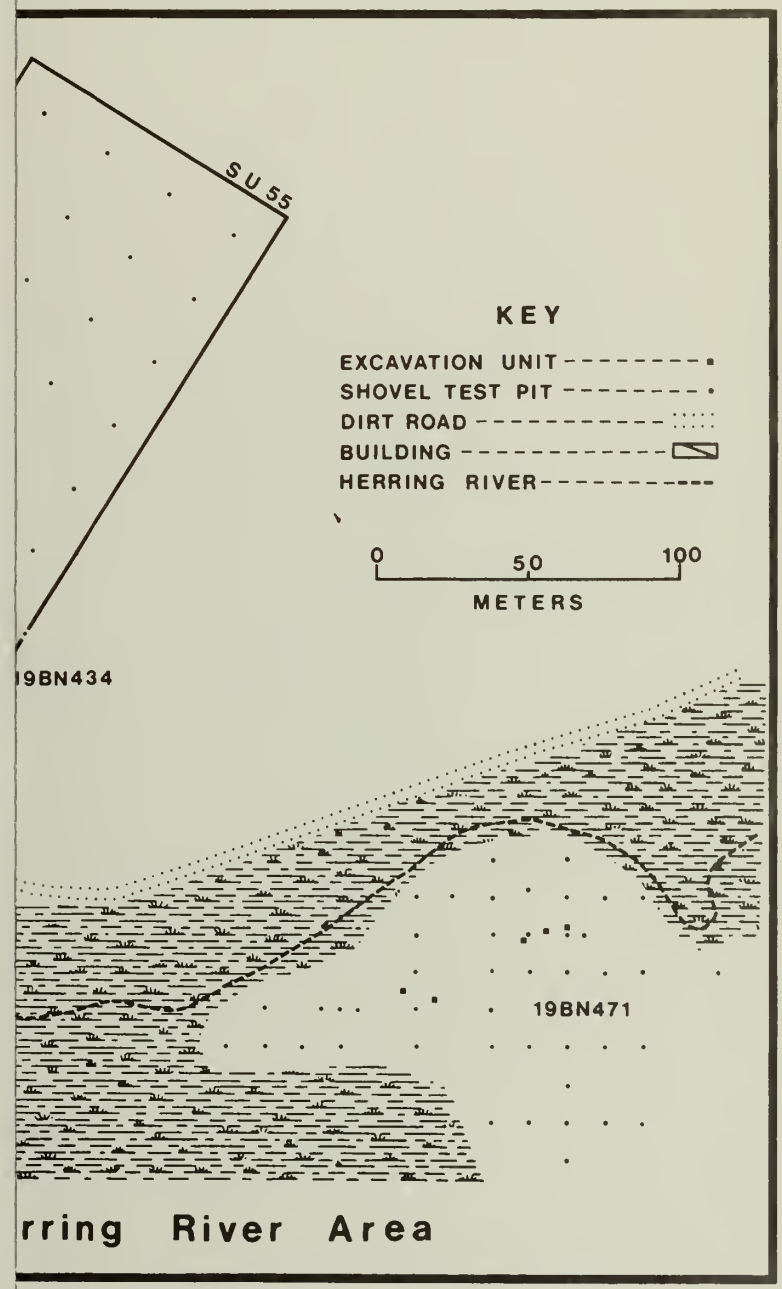
FOLDOUT H



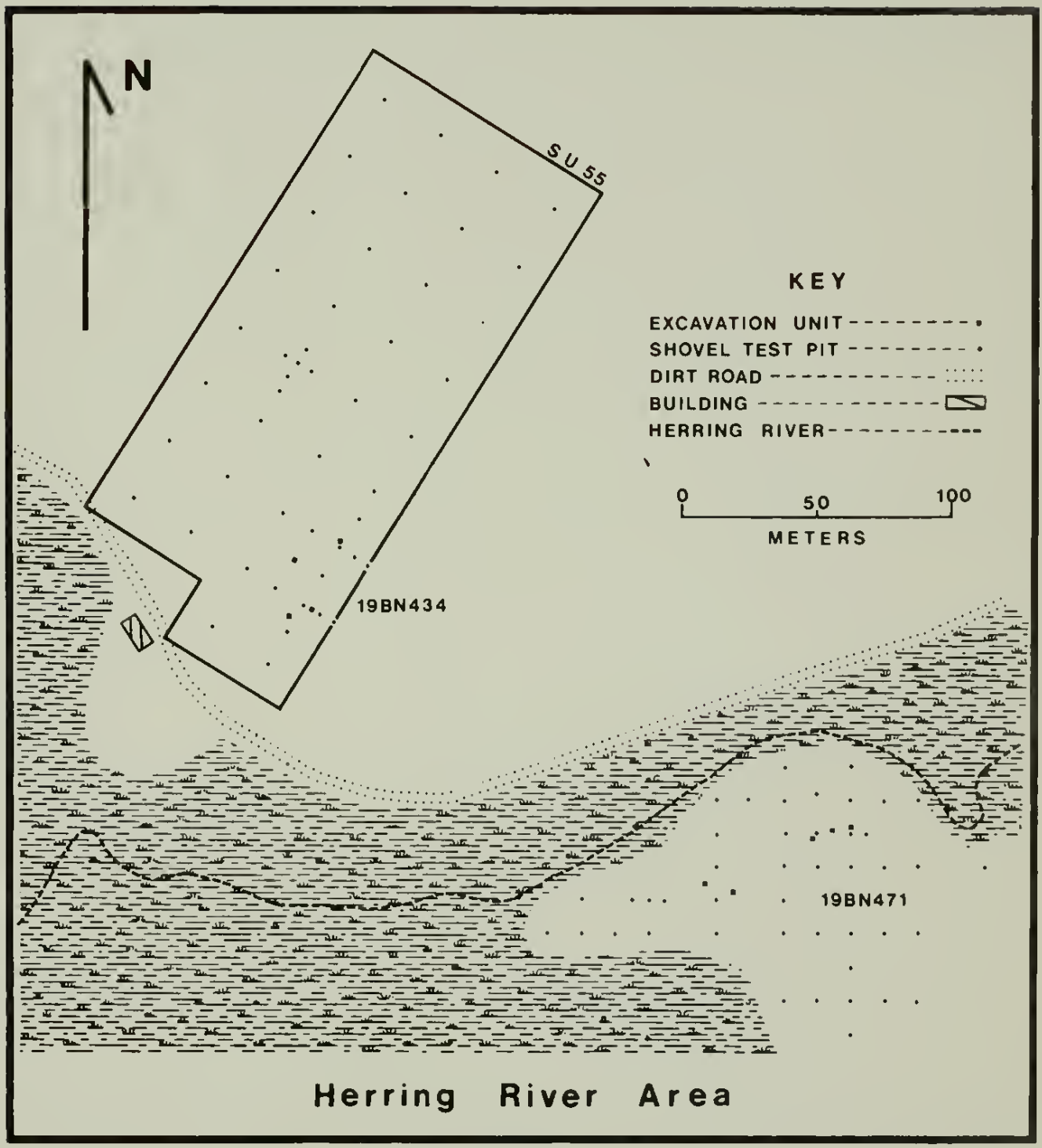
Coast Guard Beach (19BN374) Concentrations

G Stillson 7/83

FOLDOUT H

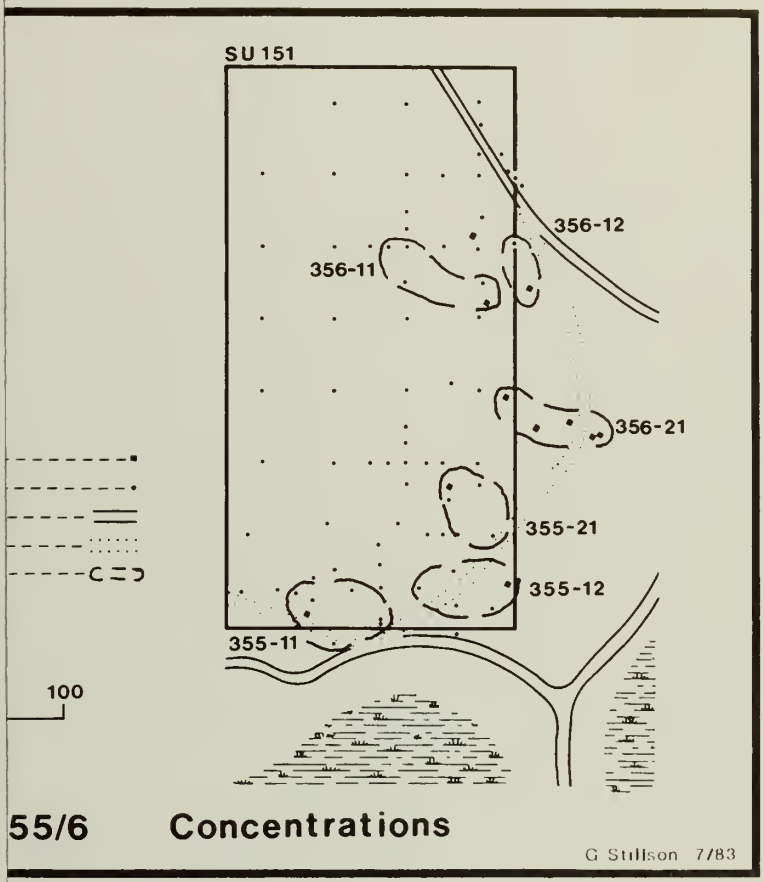

SU 55
KEY
EXCAVATION UNIT
SHOVEL TEST PIT
DIRT ROAD
BUILDING
HERRING RIVER
0
50
100
METERS
19BN434
19BN471
rring River Area

FOLDOUT I

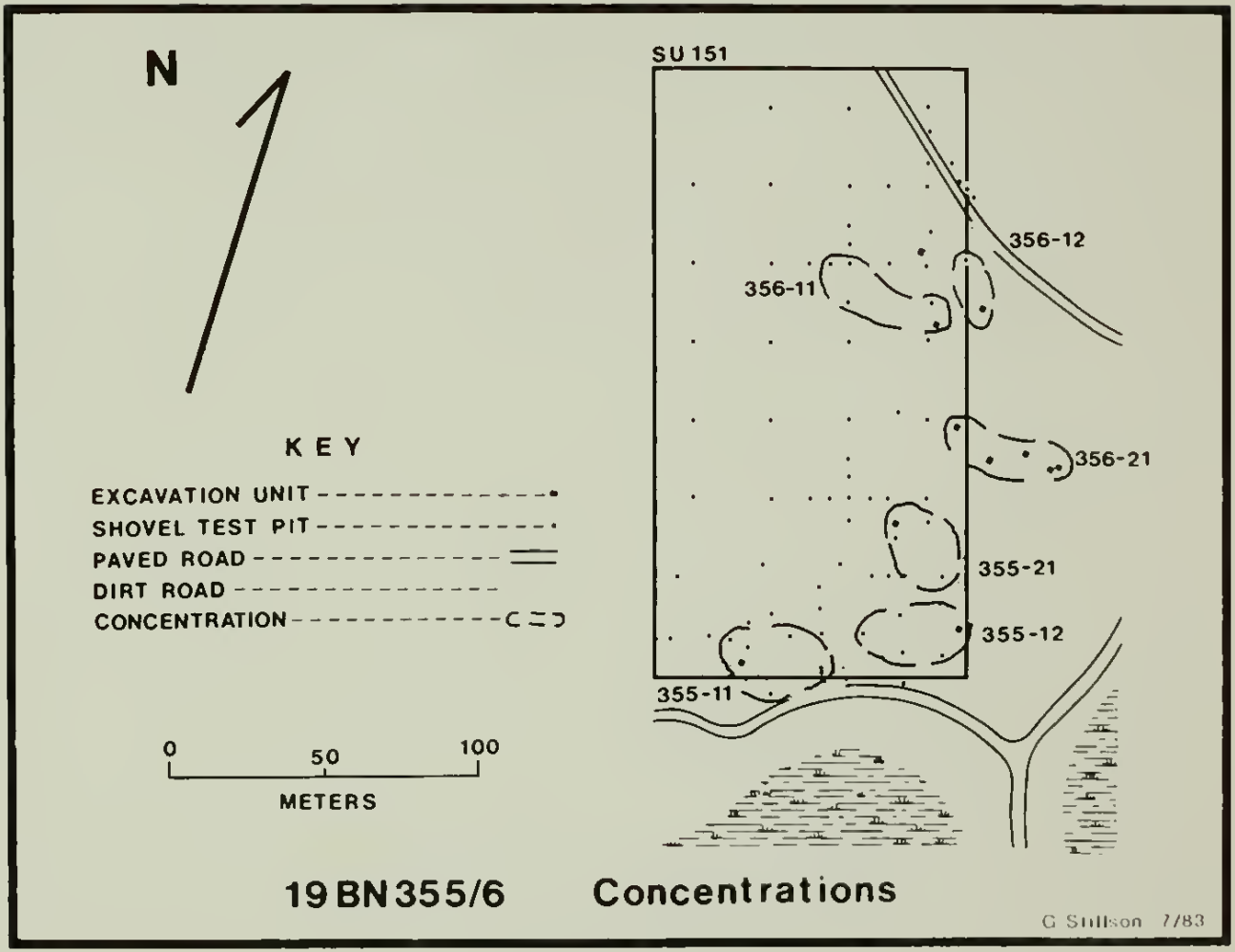


Herring River Area

FOLDOUT I

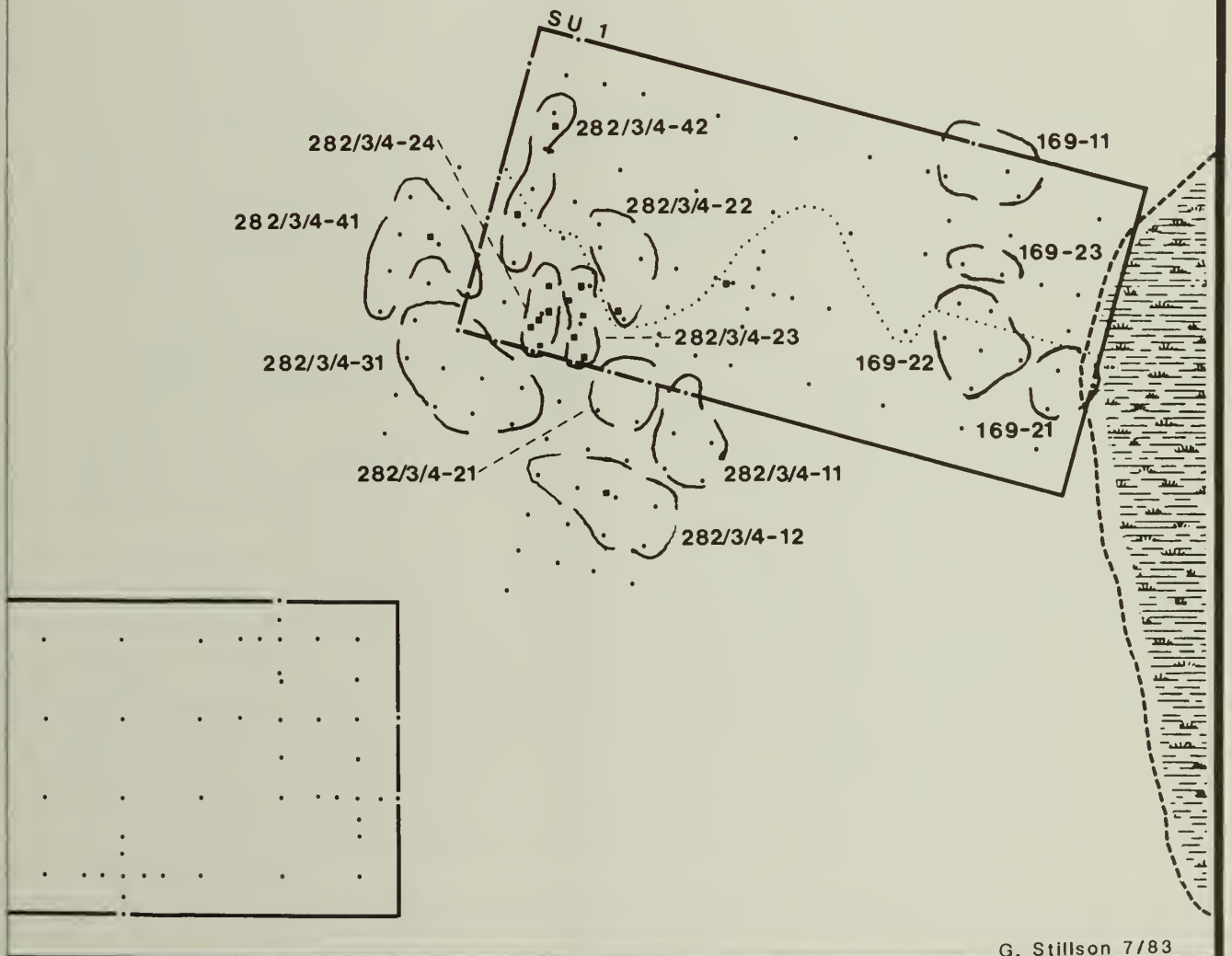

SU 151
356-12
356-11
356-21
355-21
355-12
355-11
100
55/6 Concentrations
G Stillson 7/83

FOLDOUT J


N
KEY
EXCAVATION UNIT
SHOVEL TEST PIT
PAVED ROAD
DIRT ROAD
CONCENTRATION
0
50
100
METERS
SU 151
356-12
356-11
356-21
355-21
355-12
355-11
19BN355/6 Concentrations
G Stillson 7/83

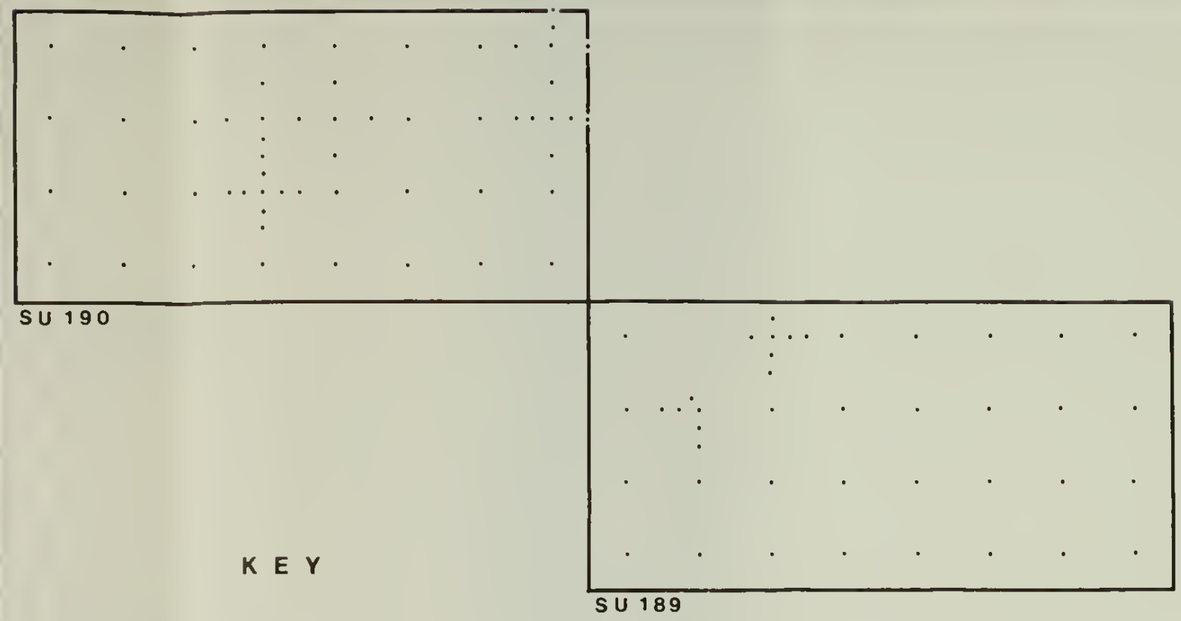
FOLDOUT J

High Head East Concentrations



G. Stillson 7/83

High Head East Concentrations

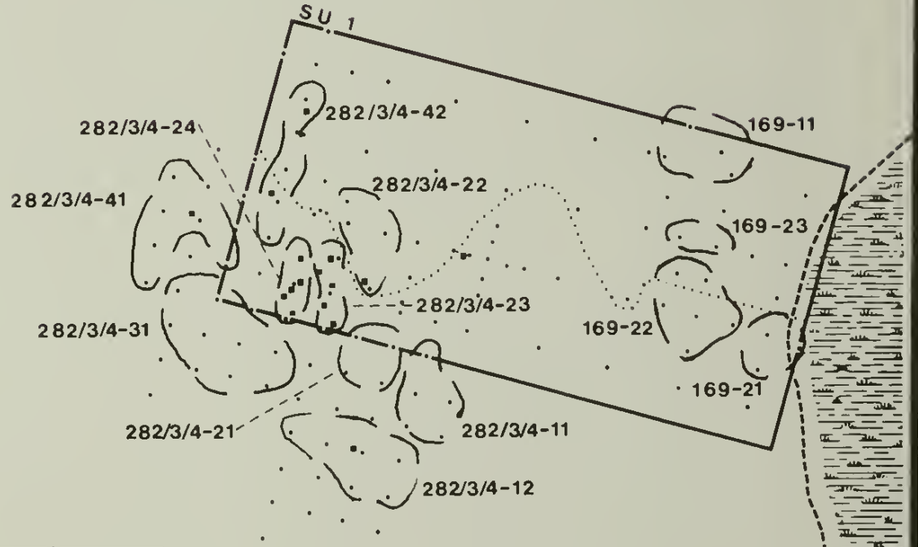


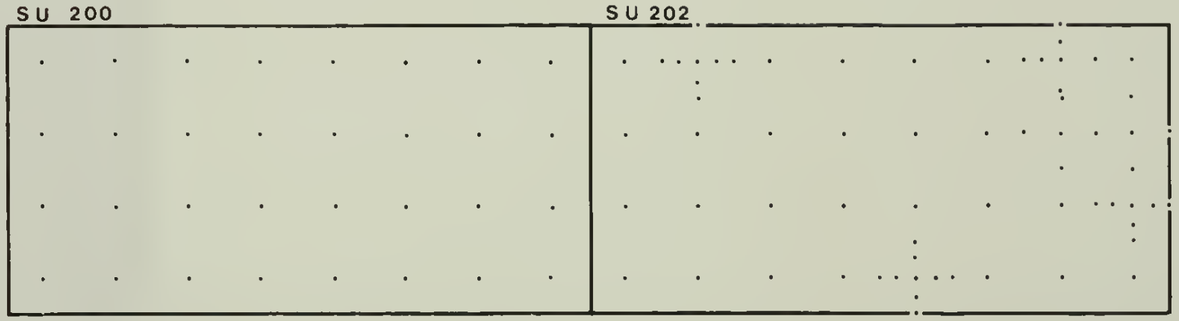
KEY

EXCAVATION UNIT
SHOVEL TEST PIT
BICYCLE PATH
FOOTPATH
CONCENTRATION

N

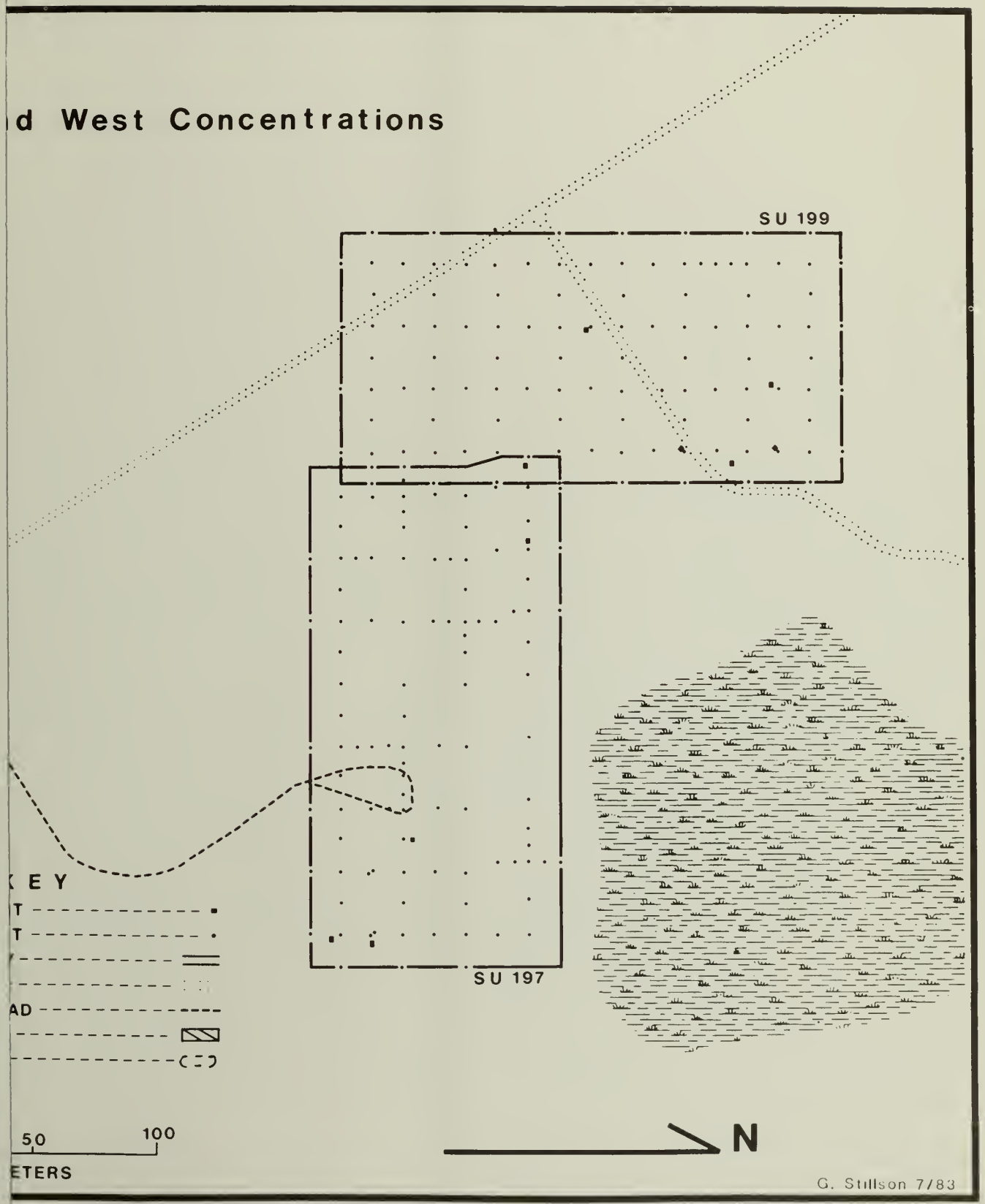
0 50 100
METERS





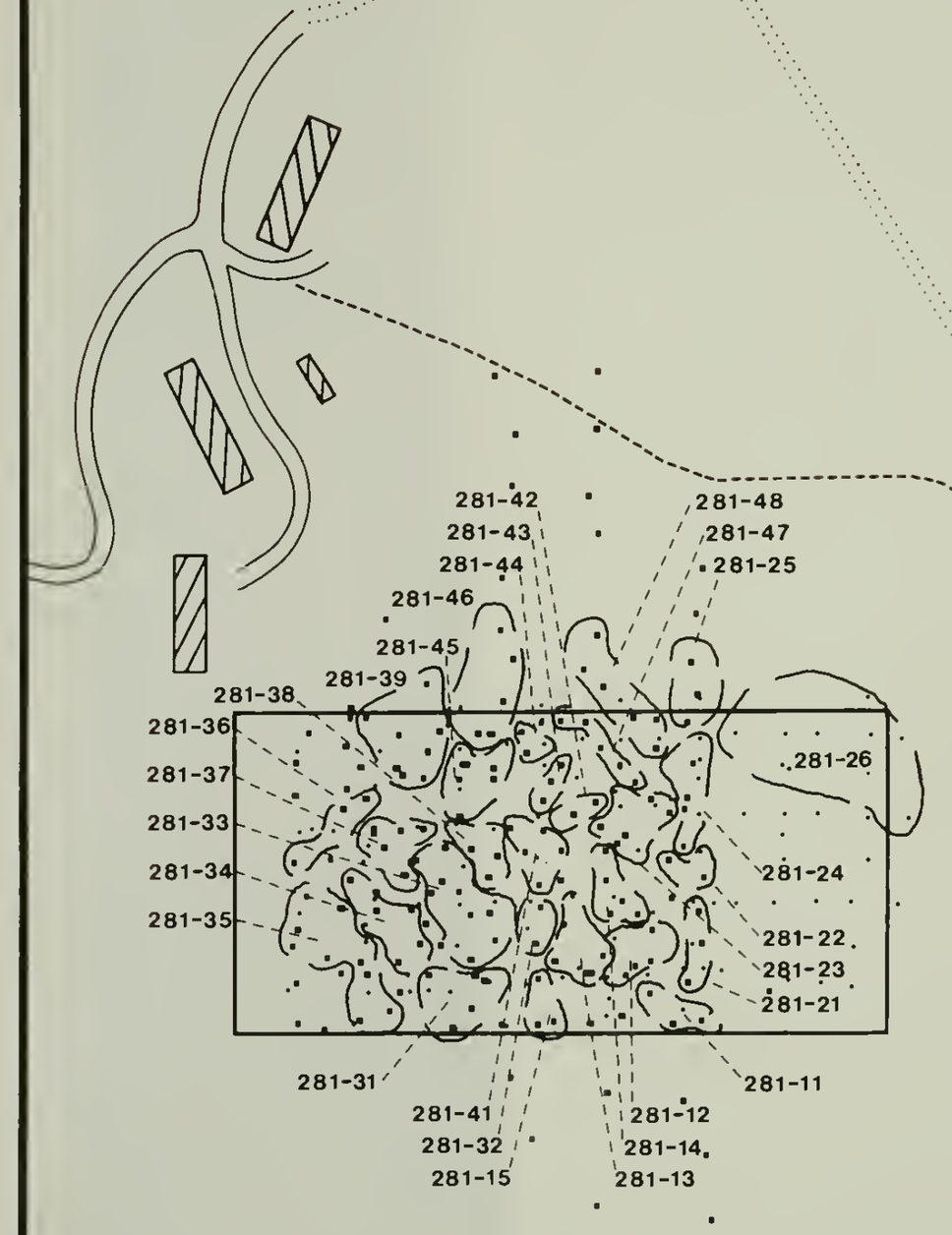
G. Stillson 7/83

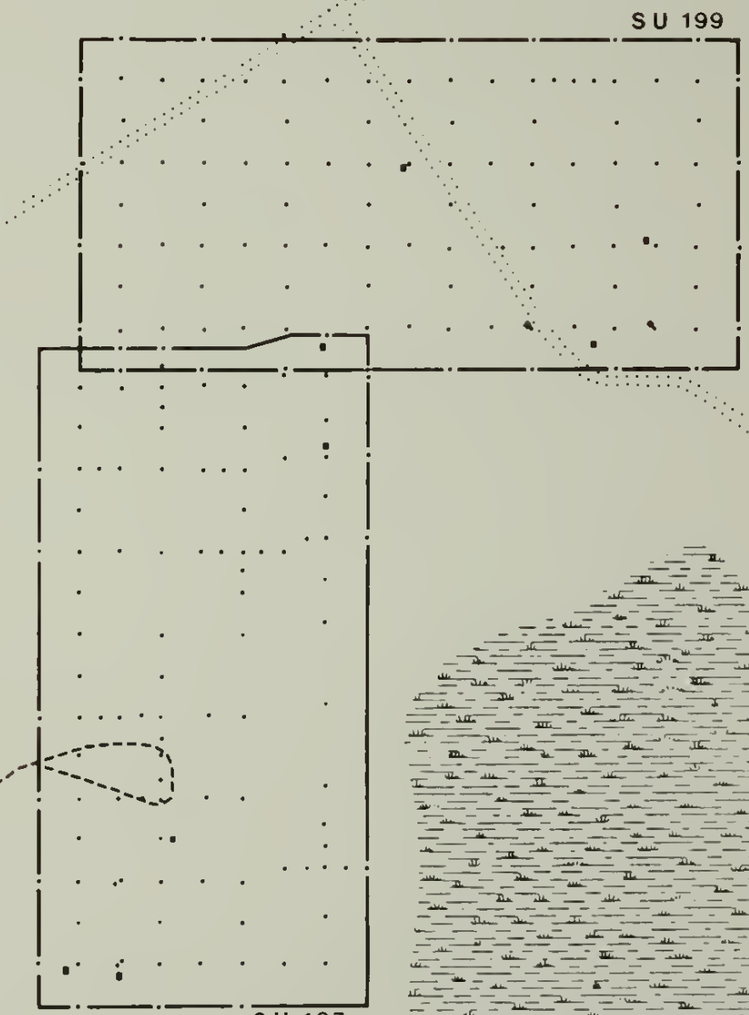
FOLDOUT K

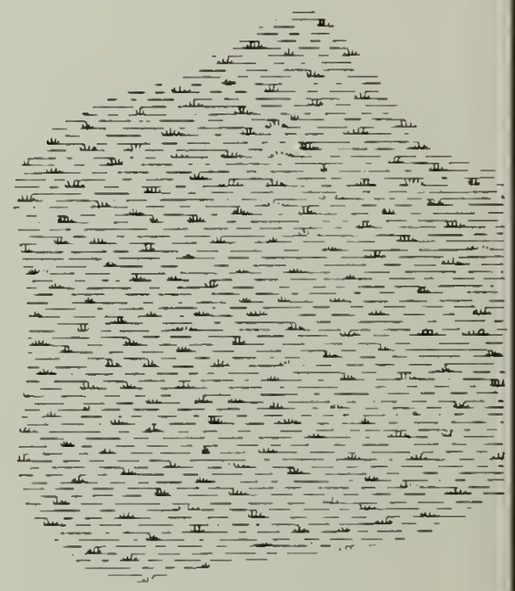

d West Concentrations
SU 199
SU 197
EY
T
T
AD
50
100
ETERS
N
G. Stillson 7/83

OUT L

High Head West Concentrations







KEY

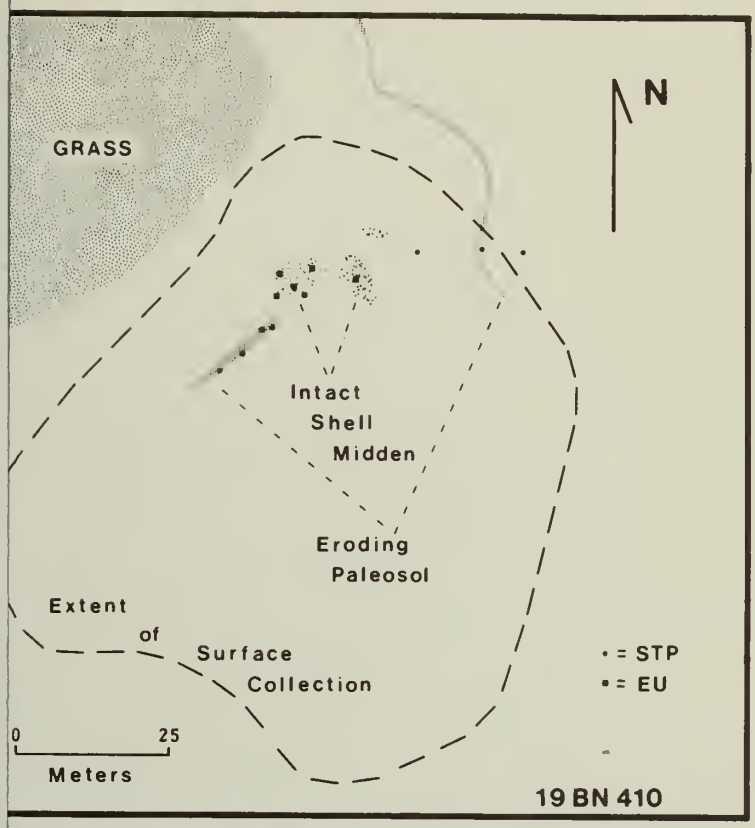
EXCAVATION UNIT
SHOVEL TEST PIT
PAVED DRIVEWAY
DIRT ROAD
IMPASSABLE ROAD
BUILDING
CONCENTRATION

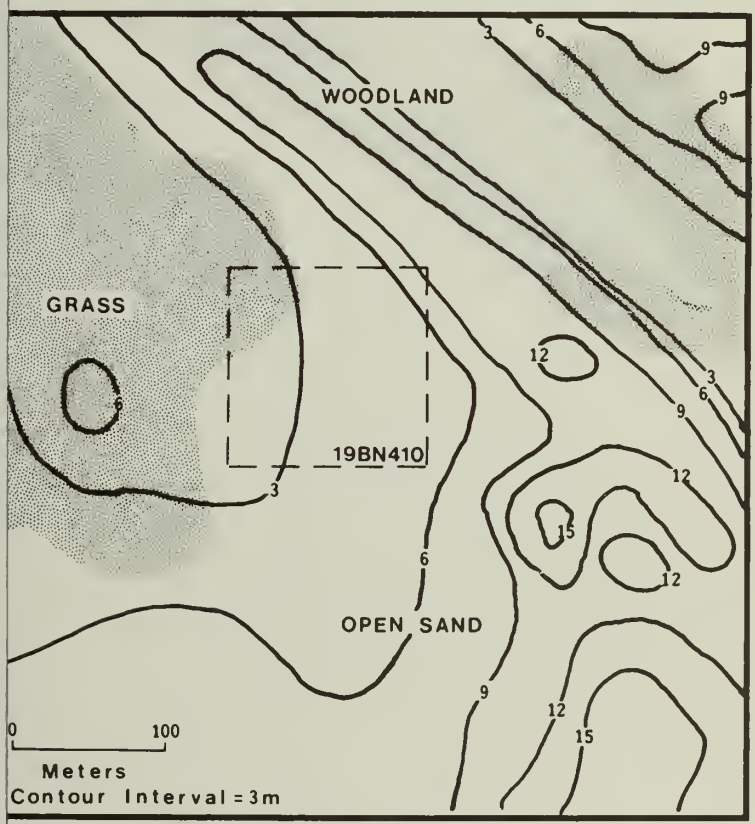
0 50 100
METERS

N

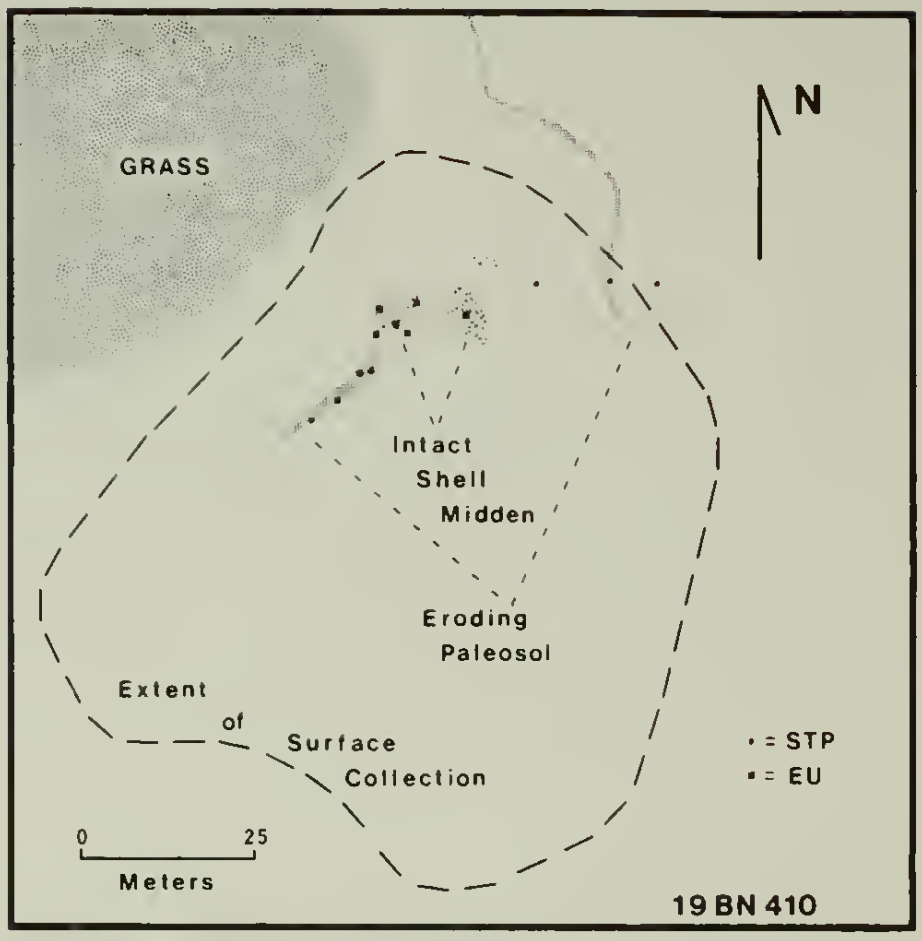
G. Stillson 7/83

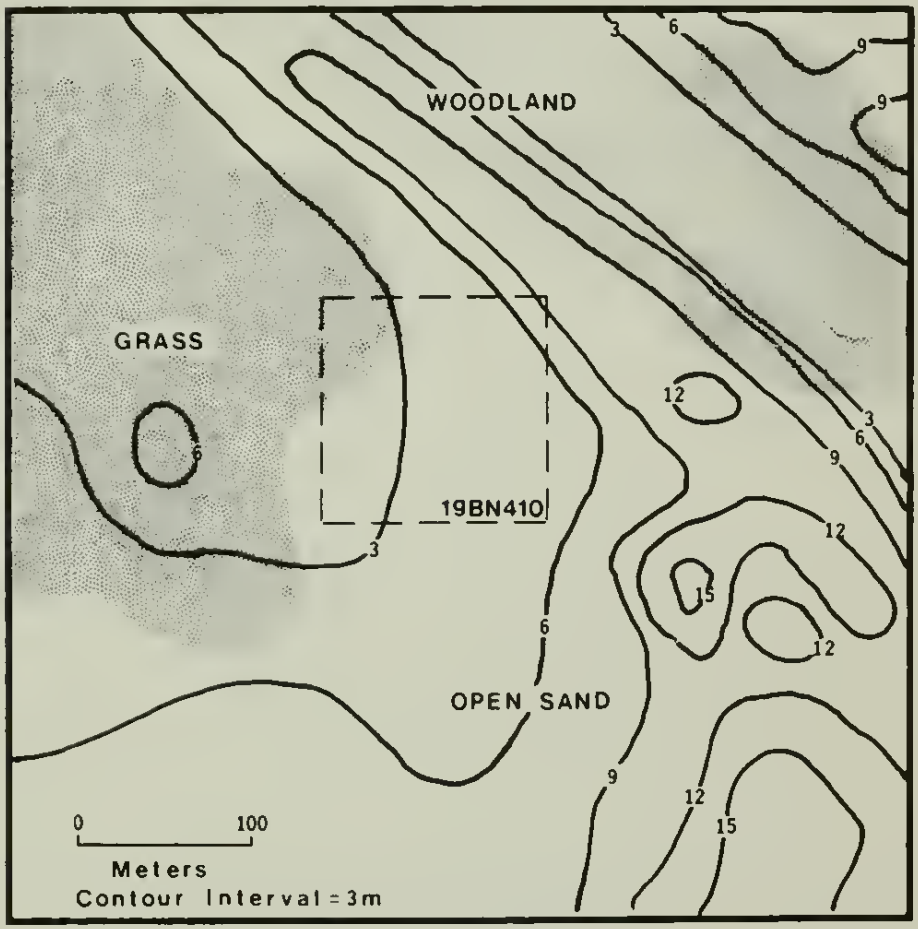
FOLDOUT L


N
GRASS
Intact
Shell
Midden
Eroding
Paleosol
Extent
of
Surface
Collection
• = STP
• = EU
0
25
Meters
19 BN 410


WOODLAND
GRASS
OPEN SAND
19BN410
3
6
9
12
15
0
100
Meters
Contour Interval = 3m

FOLDOUT M


N
GRASS
Intact
Shell
Midden
Eroding
Paleosol
Extent
of
Surface
Collection
• = STP
▪ = EU
0
25
Meters
19 BN 410


WOODLAND
GRASS
OPEN SAND
19BN410
3
6
9
12
15
0
100
Meters
Contour Interval = 3m

FOLDOUT M

REPORTS OF THE DIVISION OF CULTURAL RESOURCES
North Atlantic Regional Office, National Park Service

The Division produces and prints reports on archeological, curatorial, historical, and historic architectural topics that identify, evaluate, document, and interpret cultural resources in National Park Service units of the North Atlantic Region. Some of these reports are of general interest for their presentations of substantive, bibliographic, technical, or methodological information. These are listed below. Those that are listed with an NTIS number are only available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151. Others are available from the Division of Cultural Resources, NARO, National Park Service, 15 State Street, Boston, MA 02109. Prices are listed.

Cultural Resources Management Studies

No. 1	Archeological Resource Study, Roger Williams National Monument. Public Archaeology Laboratory, Brown University, 1979.	NTIS PB81	185134
No. 2	Archeological Overview and Evaluation at Minute Man National Historical Park. Vernon G. Baker, 1980	NTIS PB81	185142
No. 3	Historic Resources Study, Jamaica Bay: A History. Gateway National Recreation Area, New York-New Jersey. Frederick R. Black, 1981.	$4.00	
No. 4	Archeological Site Examination: A Case Study in Urban Archeology. Roger Williams National Monument. Patricia E. Rubertone and Joan Gallagher, 1981.	6.00	
No. 5	Archeological Resource Study, Historical Archeology at Bunker Hill Monument. Boston National Historical Park. Thomas Mahlstedt, 1981.	NTIS PB83	186957
No. 6	Archeological Investigation at the Narbonne House. Salem Maritime National Historic Site. Geoffrey P. Moran, Edward F. Zimmer, Anne E. Yentsch, 1982.	7.00	
No. 7	Historic Resource Study, A History of Fort Wadsworth, New York Harbor. Frederick R. Black, 1983.	4.00	
No. 8	Chapters in the Archeology of Cape Cod, I. Results of the Cape Cod National Seashore Archeological Survey, 1979-1981 (2 volumes). Francis P. McManamon, editor, 1984.	7.50 Volume 1 9.00 Volume 2 15.00 Both Volumes	
No. 9	The National Park Service in the Northeast: A Cultural Resource Management Bibliography. Dwight Pitcaithley, 1984.	7.00	

(continued on back cover)

Archeological Collections Management Project Series

No. 1	Archeological Collections Management at Salem Maritime National Historic Site. Alan T. Synenki and Sheila Charles, 1983.	$4.00
No. 2	Archeological Collections Management at Morristown National Historical Park, New Jersey. Alan T. Synenki and Sheila Charles, 1983.	3.00
No. 3	Archeological Collections Management of the Great Island Tavern Site. Cape Cod National Seashore, Massachusetts. Alan Synenki and Sheila Charles, 1984.	3.00

Other Publications

Cultural Resources Inventory, Lowell National Historical Park and Preservation District: Report. Shepley, Bulfinch, Richardson and Abbott, Architects, 1980.	NTIS PB81 189169
The Archeology of Cape Cod National Seashore. Francis P. McManamon and Christopher L. Borstel, 1982. (pamphlet 16 pp.)	1.00